A Scranton Gillette Publication

AUGUST 1961

# WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL

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**Local Citizens and P.L. 660 Solve Financing Problem . . . p. 315**

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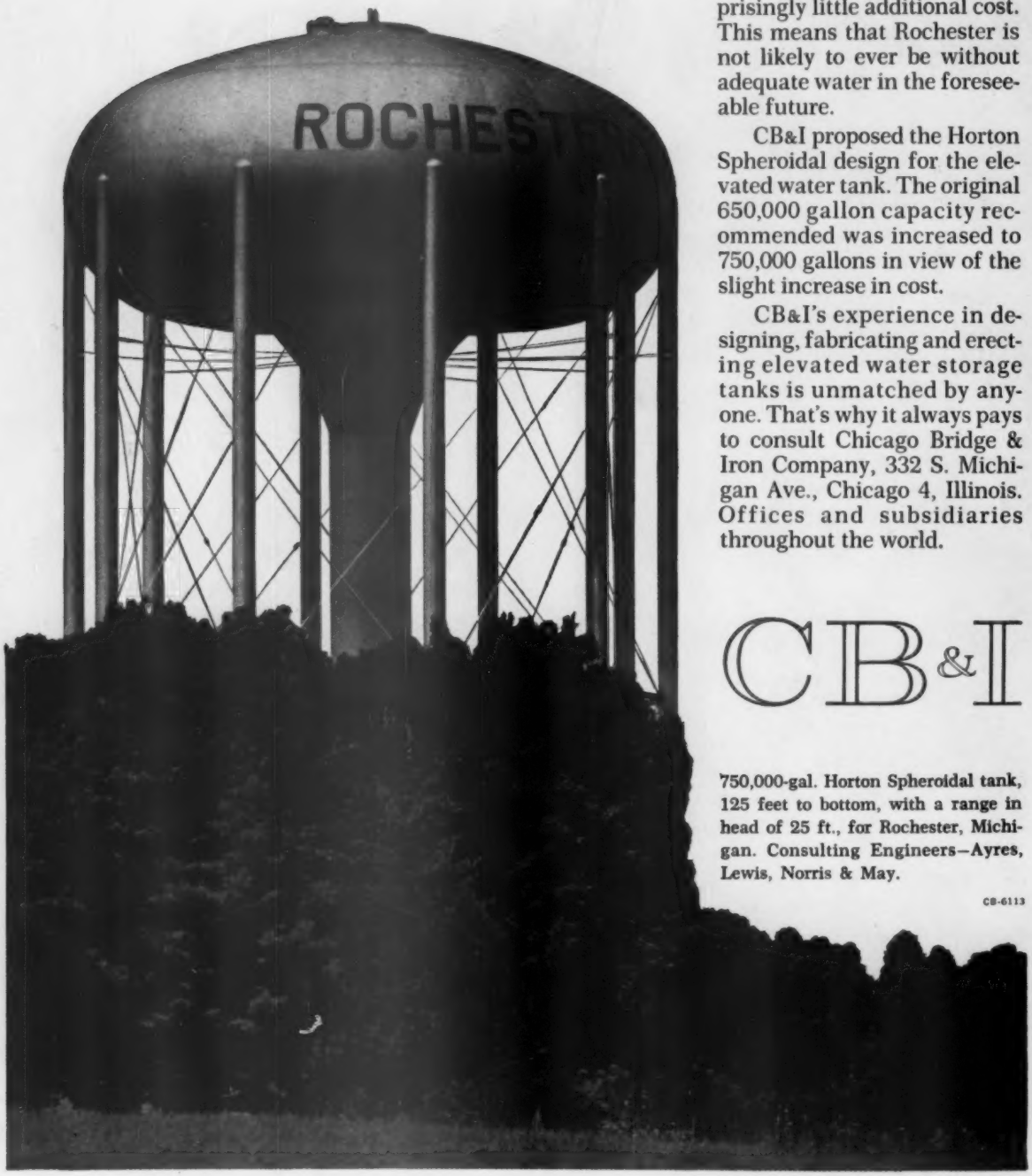
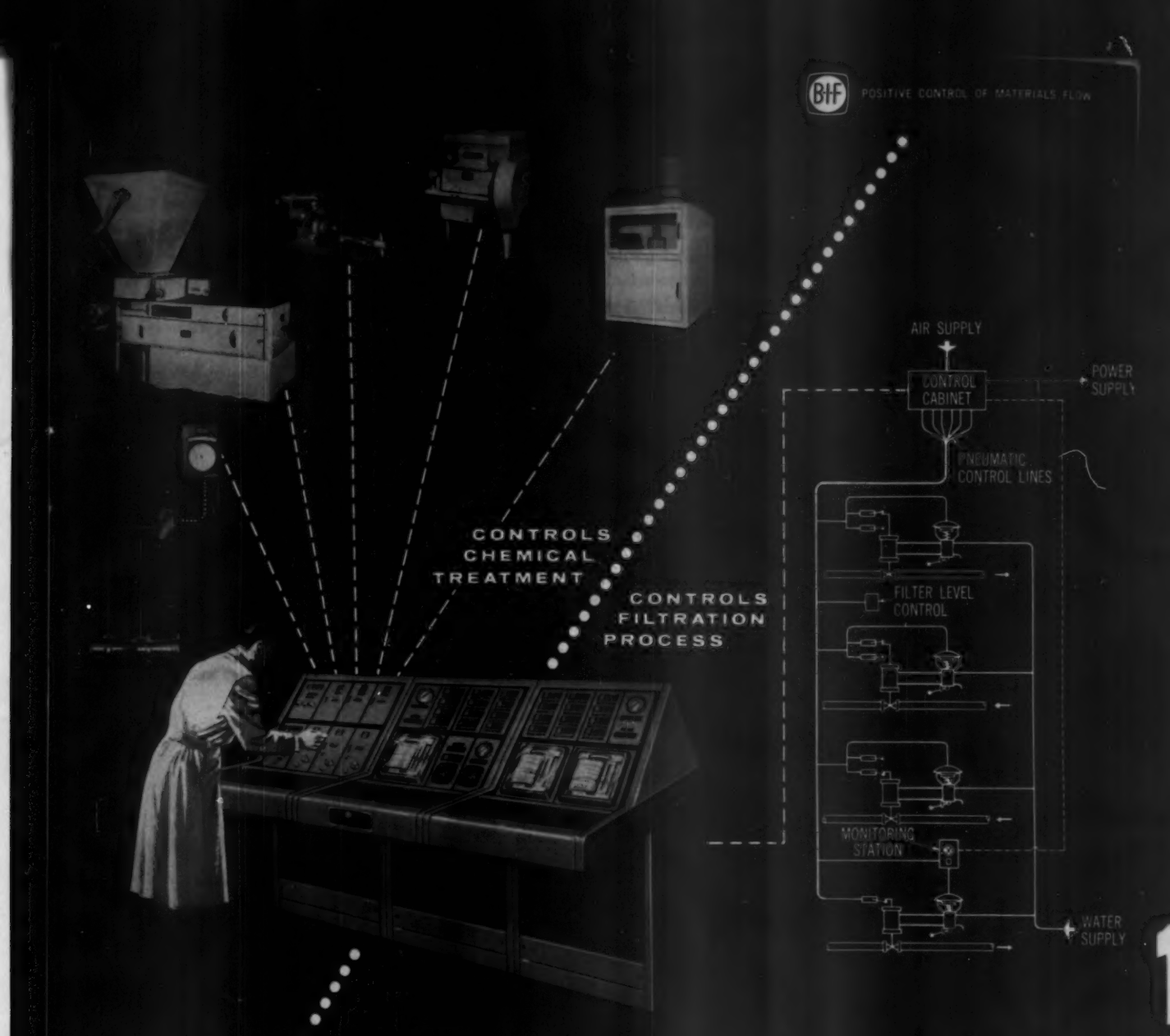



CB&I

750,000-gal. Horton Spheroidal tank, 125 feet to bottom, with a range in head of 25 ft., for Rochester, Michigan. Consulting Engineers—Ayres, Lewis, Norris & May.

CB-6113

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**WATER & SEWAGE WORKS**

**VOL. 108 NO. 8**

**AUGUST 1961**

*A Scranton Gillette Publication*

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# News—Here & There

## ISA Instrument-Automation Conference At Los Angeles

The 16th annual Instrument-Automation Conference and Exhibit of the Instrument Society of America is scheduled for Sept. 11-15, 1961 at Los Angeles.

Over 20,000 instrumentation personnel will attend this internationally recognized event, with conferences in the Biltmore Hotel and exhibits in the Memorial Sports Arena.

"Reliable Information from Underwater to Outer Space" is the theme with 80 sessions dealing with all areas of instrumentation. Keynoters will be Dr. Roger Revelle, director of Scripps Institution of Oceanography; Dr. Frank B. Goddard, asst. director, Jet Propulsion Laboratory, CIT; Dr. Allen V. Astin, director of the National Bureau of Standards; and Robert L. Wehrli, vice-president of Robertshaw-Fulton Controls Co.

## Water & Sewage Works Manufacturers Association Elects Five To Board Of Governors

At its recent annual meeting the WSWMA elected the following members to its Board of Governors. Terms will begin January 1, 1962, and continue for three years thereafter:

Russell H. Babcock—The Foxboro Company

Carl N. Brown—United States Pipe & Foundry Co.

Harvey S. Howe—Lock Joint Pipe Company

Hubert F. O'Brien—The A. P. Smith Manufacturing Co.

Harry E. Schlenz—Pacific Flush Tank Company.

## Sea-Water Converter For Saudi Arabia

A sea-water conversion plant that will produce 500,000 gallons of fresh water daily will be installed in the Saudi Arabian-Kuwait neutral zone.

Westinghouse announced that the "flash evaporator" conversion unit is to be installed by the Arabian Oil Co., a Japanese-owned firm drilling for offshore oil on the Persian Gulf.

The multi-stage distillation unit will be delivered this year complete with heat exchange equipment, pumps and drives, control panel and chemical injection equipment.

# Reader Response

Sir:

I wholly agree with the suggestion made by Mr. Carpino in your June 1961 issue. In fact, I sometimes wonder how I could operate, were it not for my file of WATER & SEWAGE WORKS references collected over the years.

Speaking of reference files, I have been meaning for several months to request two articles that I am missing. These are Part I and Part III of "Hypochlorination Guide" by Mr. Edmund J. Laubusch. I would genuinely appreciate receiving tear sheets of these articles.

**H. L. Blanford**
Major, MSC
Sanitary Engineer
Preventive Medicine Service
U. S. Army Medical Service Group
Ryukyu Islands
APO 331, San Francisco, Calif.

### Help Asked for Iskenderun, Turkey

Sir:

There are a few American families here . . . our position (is) a necessary part of the community; not isolated nor aloof from them or their problems.

A serious local health problem exists here because of a lack of mosquito control. As Commanding Officer of the U. S. Military Detachment . . . I have been requested by the local Mayor . . . to obtain information as to measures which might be taken toward the control, or possible elimination, of the mosquitoes.

In and around the city are swamp waters . . . some local effort is made to pump out the swamp waters. Such efforts are almost futile . . . Water drainage from the mountains fills all the low areas of the city during the rainy season . . . November through March.

The type of information desired would, of course, include ways and means of control, recommended products and their sources and, if possible, evaluation of the effectiveness of the various methods . . . the city's budget is quite limited.

**Rodney A. Speelman**
Captain, TC
Detachment 33-3
The U. S. Logistics Group
APO 289, N. Y., N. Y.

The condition would no doubt respond to adequate drainage, sewage collection and treatment, if a complete sanitary engineering survey so indicated. This approach, though costly, could be the least expensive solution in the long run. Assistance should be available from the U. S. Army, UNESCO, or the World Health Organization. Financial assistance might be possible through the World Bank. A permanent solution will be neither inexpensive nor easy, but the residents are going to have to **want** to improve, or any efforts to assist will be futile.—Ed.

### Why Not Wash With Soap?

Sir—If we have so much trouble with syndets, why not outlaw them? Syndets certainly are not indispensable. Why not wash with soap? If syndets endanger our water supply, the Federal government certainly has the constitutional power to forbid their use.

**Carl Beer, P. E.**
Sand Lake, N. Y.

While synthetic detergents have been demonstrated to be a nuisance in water supply and wastewater treatment, no concrete evidence that they constitute a danger has as yet been presented. We doubt that syndet producers originally visualized the nuisance impact the various products have generated. On the other hand, the producers must be given credit for their research efforts to solve the problem, through the Soap and Glycerine Manufacturers Association. This effort has sought means of degrading the product biologically and to develop efficient products which can be treated effectively by conventional means. We must admit, however, that the efforts to date have failed because ABS production and sales, for example, continue to climb.

Mr. Beer's idea has been proposed by others, though no restraining action has followed. In the absence of demonstrated danger, perhaps no such action is legally possible, further, in our free enterprise system, such action may not be desirable. Data have been collected by Illinois researchers which indicate that central water softening, plus soap as a detergent, may be the least expensive route to cleanliness. If this work turns out as expected, we might do well to encourage construction of more central, municipal water softening plants and re-educate the consumers to wash with good old soap.—Ed.

*Water and Sewage Works likes to hear from its readers. Reader Response will continue to air readers' beliefs, but keep them short and current, please. Send your response to Editor, Water and Sewage Works, P.O. Box* 1315. *Lansing Michigan.*

# AWWA DETROIT MEETING

■ THE AMERICAN Water Works Association's 81st annual meeting in Detroit last June attracted 3691 members and guests. Before the meeting ended, new President John W. Cramer and Vice-President Willian D. Hurst were well on their way to a year of hard work.

General Sessions were held which covered the following subjects.

Milton Redlich, Chase Manhattan Bank, explained that by making bond issues attractive to the investing public through strong credit rating, banks will also have a strong interest in the water industry.

John W. Cramer
President AWWA

Senator Robert S. Kerr (Dem. Okla.) told members about future planning for water needs from 1980 to 2000. Sen. Kerr told of government projects for the study of water problems and steps being taken by congress to resolve them. Five major categories of effort are needed to be intensified in the future, Kerr said: 1. regulation of streamflow by construction of surface water reservoirs and better watershed management; 2. improvement of stream quality through better pollution abatement programs; 3. better use of potentialities for underground storage of water; 4 increased efficiency of water use (including better sewage practices, recirculation, etc.); 5. greater support to research programs.

Pres. John W. Cramer told members *What AWWA Does For You,* explaining recent and growing demands for more services which have brought the Association to an impasse. The members asked for an increase in dues to cover a great increase in services performed by the AWWA and the Asscoiation has undertaken a program to give members what they want, he said.

### Other topics

The final report of the Committee on Aims and Objectives of the AWWA was presented, recommending two new standing committees on research and education. The Board of Directors voted on the increase of membership dues, required in order to expand the Association's activities. A steering committee was approved to employ a management consultant on phases of Association affairs, determine the scope of the consultant's activity, and present final recommendations to the Board of Directors covering future AWWA activities.

A report was presented on investigations of evaporation from free water surfaces and snow fields in the Sierra Nevada Mtns and a comparison to the Alps of Central Europe which are losing water supplies and power potential.

The Advancement Program of the AWWA was discussed and three basic requirements for the achievement of "advancement" were stated: 1. better methods and materials; 2. better management and operators; 3. higher standards of water quality and water service. Higher rates were advocated but, they said, to make money available to water utilities, the public must understand what can be accomplished with it—and must support that accomplishment. Therefore the pubilc must be informed. And all levels of AWWA must help in this effort.

The WSWMA Pubic Relations Program has also increased in efforts to advance water programs. Working both on the local and national levels, it has nearly doubled the flow of informative material within one year through all communications media.

A challenging and complete training program for water works managers was suggested. There are some short course programs now but these generally reach only those who do not have the need, and over specialized areas which do not express the majority of regions which should be covered. The suggested school should teach accounting, finance, organization, motivation, report writing, English, mathematics, chemistry, hydraulics, and water utility planning.

William D. Hurst
Vice President

### Resources Division

Seattle, Wash., after 1962, will be supplied with water from two rivers, the Cedar and the Tolt, and will develop 650 mgd from the combined watersheds. This is two-and-one-half times the present maximum demand. In the Colorado River Basin, however, water is the only resource which is not in abundance.

Water supply on the moon is presenting a curious problem for resource men. No evidence of such sources has been obtained but research is being carried on to discover how

CONTINUED ON PAGE 7A

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## AWWA DETROIT

(CONTINUED FROM PAGE 5A)

much and how water may be obtained and used.

A report was presented on the work of the US Geological Survey and Kalamazoo, Mich., in a project involving induced ground water recharge. Water levels were observed to decline less and recover faster in leaky artesian aquifers composed of glacial drift after recharge facilities had been constructed than under natural conditions.

Statistics in one report show the withdrawal use of water in the U.S. during 1960 was almost 290 bgd, exclusive of water used to develop power. This amounts to about 1,600 gpcd. Only 28 percent of the water withdrawn, or 82 bgd, was consumed. Consumptive use amounts to less than 460 gpcd. Household use amounted to 16 bgd, of which 88 percent was served by public water supply systems.

A recent survey of state officials who administer water laws reveals that state water laws have common strengths and weaknesses. These officials are increasingly in need of legislation by which local bodies may organize to plan and support the water resources of individual basins. The rapidly changing water scene will continue to make water legislation a dynamic and significant force in the economies of many states. Michigan, for example, lists 11,037 inland lakes, 33,350 mi of inland streams, 36,575 sq. mi of Great Lakes abutting on 2,274 mi of shoreline, and extensive ground water reservoirs. These resources are sustained by an average annual rainfall of 31 in.

"Water quality" is not a simple term to define. It depends on the intended use of the water. Research is needed to define relationships between geochemical processes and quality. It is also needed to develop more useful and exact quality criteria for water used by industry and for public supplies. Because of the widespread reports of water contamination by synthetic detergents in the U. S., an investigation has been undertaken to determine the extent of bacterial growth that can be supported by these products. Results were reported as a percentage difference from the control for two strains of bacteria, *Escherichia coli* and *Pseudomones intermedium*.

Measures to prevent entrance of numerous contaminants, both organic and inorganic industrial wastes and organic and chemical constituents from domestic waste, into potable water sources range from the most simple to the most complicated. A few of the necessary measures include adequate and uniform laws and better teamwork on the part of all personnel interested in water management.

One report said that wastes from the food-and-paper-processing industries contain large amounts of putrescible organic matter which tend to deplete the oxygen resources of the water into which they are discharged. In the aggregate, the biochemical oxygen demand of the wastes from these industries probably exceeds that of all domestic sewage in the country.

### Purification Division

Tests with a variety of filter types over a 16 year period have shown that filters of anthracite and sand together are superior to filters of either material alone. Filters made of six in. of sand of 0.43 mm effective size and 24 in. of anthracite of 0.9 mm

CONTINUED ON PAGE 8A

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effective size are superior to all other types used. The best and most economical way to increase the capacity of an existing rapid sand filter plant is to increase the filtration rate rather than build additional units. Experiments indicate that a filter aid or conditioning chemical must be used in addition to the alum in order to operate at higher filtration rates without causing breakthrough.

New methods of isolation and separation of colored substances, due to organic anomalous properties, were presented together with an account of the physical and chemical nature and biological significance of the materials.

Instrumentation and automation are becoming necessary to combat rapidly mounting costs (chiefly labor), for closer supervision and the desire to improve the product. Although judgment cannot be replaced, automation can perform accurately and quickly in many fields where human efforts are slow and failures can and do occur. Already automatic measurement and control of pressure, temperature, liquid level and fluid flow are quite common in the water works field.

A suggestion was made that the development of a rating scale for water quality be based on the assumption that a rating be flexible. The schedule should be equally applicable to systems that have monthly averages of daily measurements or yearly averages of monthly or weekly measurements. And since there is a lack of knowledge about consuming of toxic chemicals or common minerals and their effects, the development of an improved water quality control technology should be accepted as a challenge by scientists.

Investigations are being carried on at the University of Michigan to develop an understanding of the mechanisms in sand filtration of dilute suspensions. Variables observed have been bed penetration, time rate of clogging and efficiency of removal. Physical parameters of sand size, flow rate, bed depth and type and number of algae have been varied. The introduction of iron floc to the filter influent has been initiated and preliminary results are available.

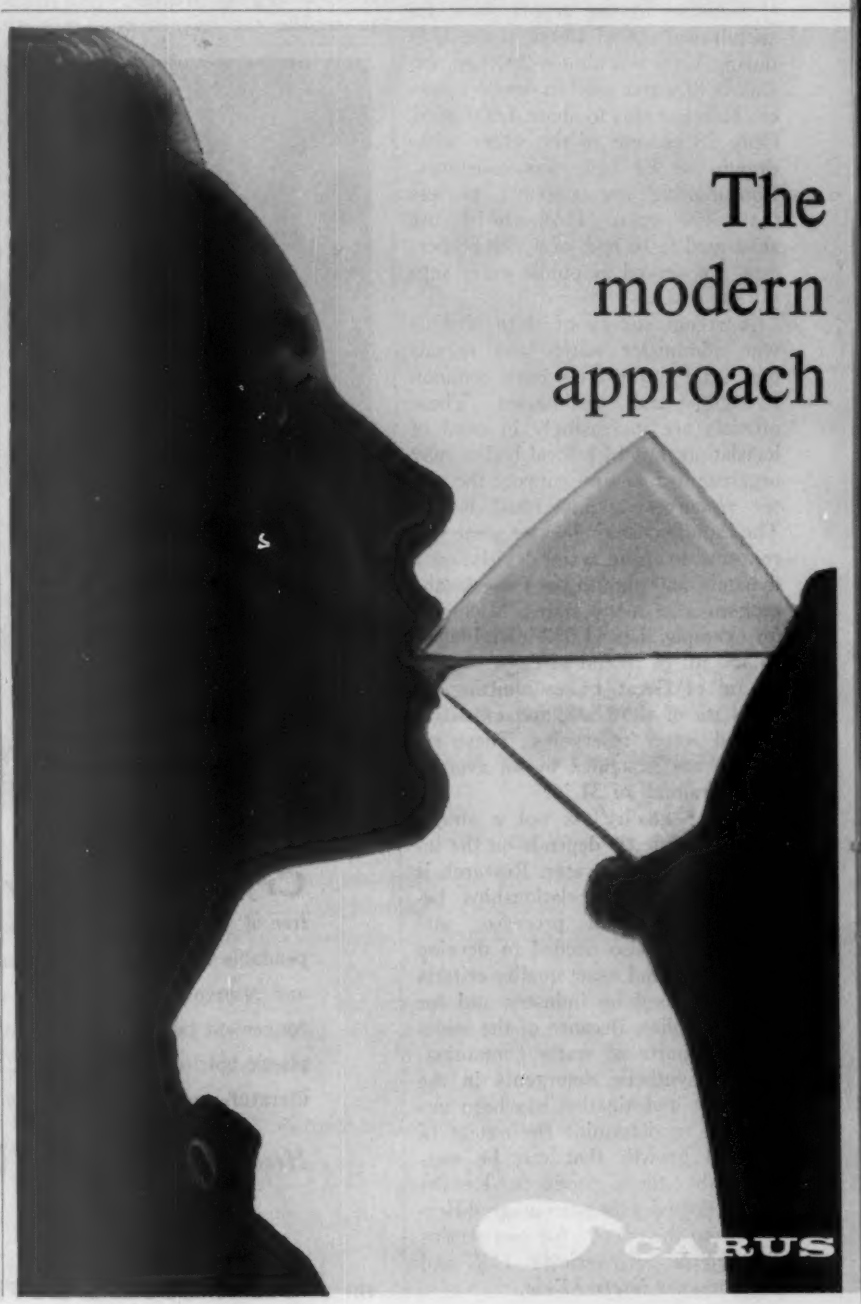
The Detroit department of water supply was reported as having problems with occasional slugs of industrial pollution due to a heavy concentration of chemical and oil industries above the intake. Special treatment and laboratory control in four filtration plants caused a better effluent with the use of 22 percent less coagulant.

AWWA Committee 2770P reported on brackish water conversion. Municipal water utilities in the U. S. and Canada were surveyed and it was found that 1,094 out of 20,215 had dissolved solids content above 1,000 ppm, many much higher.

### Management Division

Unsuccessful efforts of Gary, Ind., city fathers to purchase the privately owned water utility were described. Company action to defeat the proposal began with the employment of a public relations firm in the early summer of 1959 and concentrated on a crash campaign in the winter of 1959-60. The campaign stressed the utility's good record of service through advertising media.

The maintenance of an ample supply of clean, safe water continues to be the number one natural resource problem. In many areas the total de-



mand for water exceeds supply, meaning reuse of available water. This means more research, more action for keeping water clean and more public awareness to ensure public support of necessary programs.

### Distributions and Management Divisions

An AWWA committee report states that the average annual salary for a water utility manager in the U. S. was $5,960 and of the registered professional engineers in the water industry. 72 percent receive less than $9,000 per year. Recommendations were that small-town water utility managers have at least a high school education and those of cities over 25,000 have college degrees.

In a report about water quality, such factors, based on a discussion of standards, as temperature, turbidity, color, iron content, manganese content, total solids, taste and so on were suggested.

Rates, according to one speech, may now be readjusted on a modern business basis since the public is becoming aware of the value of water. A rate increase must be planned. No modern utility should wait until the issue is acute before studying rates.

Adequacy, on the other hand, is a different matter. It appears that two factors, type of system and economic situation, influence judgment of system adequacy. Accounting practices also enter in. A tentative scale was published in the April issue of *Willing Water*. It must also be realized that no water utility has the means to maintain a complete staff of quality engineers but the best available engineers should be those who keep complete engineering records for future operations.

Many factors enter into the problems of planning; population growth, technological advances, appliances, suburban development, etc. Whatever long-range scheme is adopted, it should be flexible enough that any normal change in community plans will not destroy its usefulness.

Management must use tools to keep the public informed, not only of the future but of the past. Some of these are annual reports, newspaper features, motion pictures and speeches. An adequate program of public relations will keep the water users informed of all problems and changes in your operations.

### Distribution Division

Los Angeles (pop. 2,500,000), with an area of 458 sq mi, is being supplied with 715 cfs annually at elevations from sea level to 2,440 ft by three sources: local ground water, the Los Angeles aqueduct and Colorado River water. The system has 94 reservoirs and tanks, 79 pumping plants, and 185 pressure-reducing stations to supply 100 pressure zones. Small-diameter manifolds are being used as energy dissipators and flow controllers on reservoir and sump inlet lines to alleviate valve erosion, vibration, and noise.

Right-of-way acquisition was a topic of considerable interest. Since costs of detouring of large pipelines exceed rural land and easements are often not the answer, there is a great need for skilled public relations in right-of-way negotiations, including use of local appraisers, negotiators and legal counsel.

Too often it is assumed that a good,

CONTINUED ON PAGE 94A

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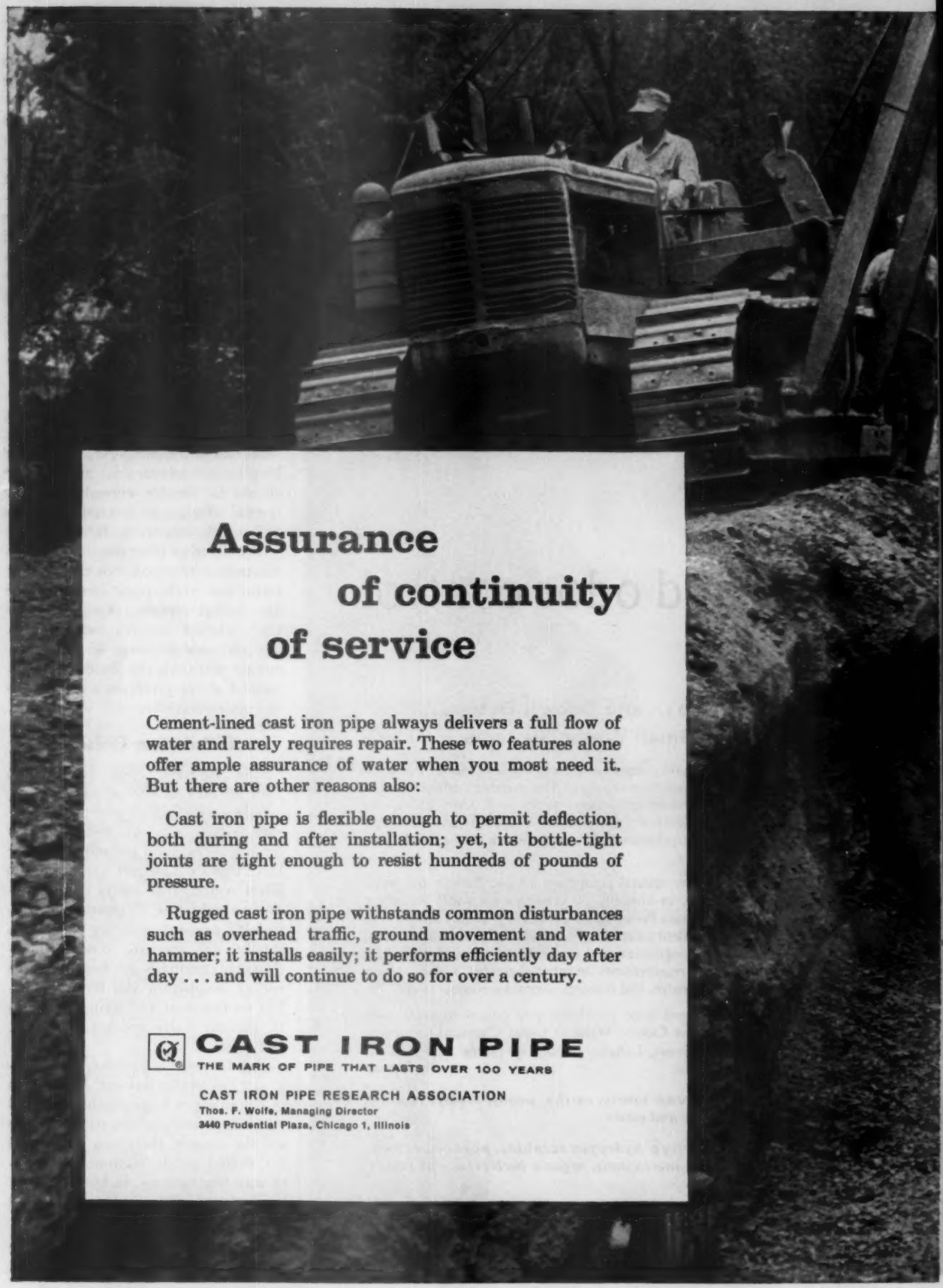
CHEMICAL COMPANY, INC.



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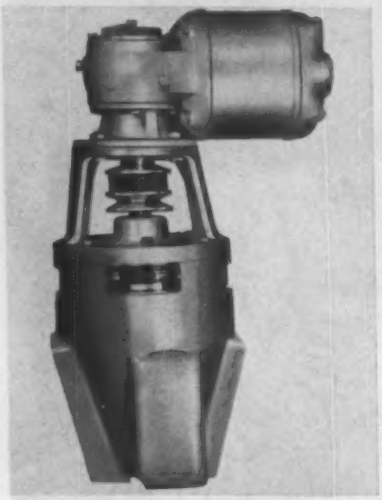
For further information on products or services please use reader service card.

## Small Comminutor With Two Way Cutting



A new compact 4R Comminutor with two-story cutting has been announced by this manufacturer of building pumps and sewage treatment equipment. The Comminutor is a new concept in reverse rotation comminution that performs continuous screen cleaning and extends cutter and comb life.

This Comminutor is the smallest offered by the manufacturer, being only twenty five inches tall and having a four inch drum. It has been designed especially for use in packaged sewage treatment plants, lift stations, marine installations, etc. Odor-free, nuisance-free and trouble-free, the Model 4R Comminutor applies wherever the cutting and screening of waterborne sewage solids is essential to proper sanitary treatment. The new unit is easily handled by one man and readily adaptable to a variety of applications and mounting arrangements. The unit is designed for flows of 15,000 gallons in eight hours to 30,000 gallons in twenty-four hours.—Chicago Pump Div., Food Machinery and Chemical Corp.

Circle No. 801 on Reader Service Card

## Magnetic Drive Meters

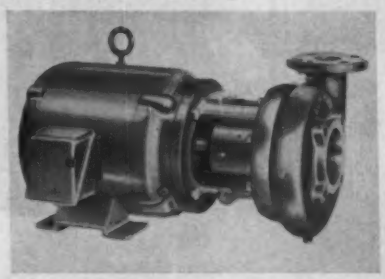
A new 5/8 in. magnetic drive meter which operates on the nutating disc principle was recently introduced by this manufacturer.

The unit is constructed with a disc meter chamber. It is driven by a magnetic coupling designed to drive any register or meter-driven accesory on the market.

The register face has digits that are 1/4 in. tall, permanent and molded integral with the wheel. A sixth number wheel has been added, extending the totalizer capacity of the meter to 10 million gallons (1 million feet).—Badger Meter Mfg. Co.

Circle No. 802 on Reader Service Card

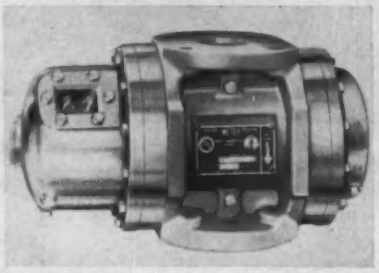
## Close-Coupled End-Suction Pumps



Especially designed for high efficiency and practical economy, the new Type GBH Pumps, announced by this manufacturer, provide required capacities and heads with less horsepower, reducing initial investment and operating costs. Capacities range up to 1600 gpm and heads to 330 ft. Maximum compactness with close-coupled end-suction design saves valuable space, permits fast installation, and makes these pumps especially suitable for OEM applications, air conditioning systems, cooling towers, boiler feed, condenser circulation, and a wide variety of transfer, chemical, industrial and general services.—Aurora Pump Div., The New York Air Brake Co.

Circle No. 803 on Reader Service Card

## Rotary Positive Displacement Meters



This manufacturer has added a 7000 CFH (168M CFD) Model 7M125 to its line of rotary positive displacement meters. The new Line-Mounted Rootsmeters are recommended for production, transmission, distribution, intraplant or institutional gas measurement at pressures to 125 psi.

The new meter is compact, easily installed, permanently accurate, and requires minimum maintenance. Model 7M125 is approximately 18" x 9½" x 9½". Connections are flanged to ASA C.I. standards for easy mounting in a 3-inch pipe. No special supports are required for mounting the meter either vertically or horizontally.—Roots-Connersville Blower, Div. of Dresser Industries.

Circle No. 804 on Reader Service Card

## Multi-Layer Sectional Pipe Insulation

A multi-layer-type sectional pipe insulation, useable up to temperatures of 1200° F, is available from this manufacturer of asbestos-cement building materials and industrial insulations.

Called "Zebra," the new sectional insulation is composed of bonded felts of calcimu silicate and asbestos fiber, Sections are easy to cut and fabricate on the job. Multi-layer construction provides toughness and vibration resistance that makes the insulation easy to install without breakage. The multi-layers are crush-resistant under the loads created by workmen who might need to walk on, or place ladders against covered runs of pipe.—Keasbey & Mattison Co.

**Circle No. 805 on Reader Service Card**

## Colony Marker and Tally

With the instrument offered by this manufacturer, an electrically controlled tally and summary are made at one time.

In colony counting, an inkmark is made on the bottom of the Petri dish directly over the colony. Each act of marking causes an electrically operated tally to advance by one. When all of the colonies in an area or dish have been marked, the tally is read to obtain the total number of colonies. The tally then is reset to zero with the reset knob, and the instrument is ready to use for counting the next plate. The new instrument takes the drudgery and error out of the counting of bacterial colonies.—Klett Mfg. Co.

**Circle No. 806 on Reader Service Card**

## Water Pressure Regulator for Household Service

A new series of water pressure regulators for household service has been announced by this manufacturer.

Designed to eliminate problems of water hammer, excessive splashing, water waste and rapid wearing of faucet parts caused by high water pressure, the Type E-23 Regulators are primarily a competitively priced series with sufficient capacity for most small homes. They are available in ½, ¾ and 1 in. sizes.—A. W. Cash Valve Mfg. Corp.

**Circle No. 807 on Reader Service Card**

CONTINUED ON PAGE 14A

let
VICTAULIC
cut your piping costs
Let the Victaulic Method save you money on piping costs. Whatever piping material you choose, Victaulic can join it and provide fittings. You save in material cost, in installation time, and in reduced piping maintenance cost.
CUT COSTS WITH OVER 1100 VICTAULIC ITEMS FOR BETTER AND EASIER PIPING
Standard Couplings
Lightweight Couplings
Rigid Couplings
Roust-A-Bout Couplings
Snap-Joint Couplings
Plainlock Couplings
Malleable Iron Fittings
Stainless Steel Fittings
Aluminum Fittings
Nipples and Adapters
Lined Fittings
Cast Iron Fittings
Plainlock Fittings
Vic-Groover Tools
Vic-Easy Tools
For complete information on any Victaulic product, write:
VICTAULIC
COMPANY OF AMERICA
P. O. Box 509, Elizabeth, N. J.
Plug Valves

# Equipment News

CONTINUED FROM PAGE 13A

## Sludge Reader for Automatic Sludge Pump Control

The Sludge Reader offered by this manufacturer eliminates any problem associated with maintaining proper sludge consistencies for better efficiency of sewage plant operation.

Utilizing harmless nuclear energy, the Sludge Reader will react to changes in solids concentrations passing through the line and, at a predetermined mined level, controls the sludge pump. When the Sludge Reader stops the pump, an adjustable timer (zero to 60 minutes) takes over and keeps the pump turned off. At the end of a preset time, the pump starts again, minus the control of the Sludge Reader. When the line is cleared the Sludge Reader takes over once again.—Komline-Sanderson Engineering Corp.

**Circle No. 808 on Reader Service Card**

## Cutting Machine

Identified as the ABR-A-SAW, this low cost cutting, machine is made with all of the high quality and identical specifications of the large capacity, higher-priced, standard models. Employs all sizes of abrasive wheels up to a maximum of 20 in., plus operating with motors up to 10 hp for high production, low cost cutting. Cuts up to 6 in. pipe and shapes 4 in. solids ferrous or non-ferrous materials.

This lightweight, portable model may be mounted on a bench with lever controlled chain vise, or on a stand with foot-pedal assembly, leaving the operator with both hands free.—Collins Machinery Corp.

**Circle No. 809 on Reader Service Card**

## Gallon-per-Stroke Hand Pump

A new self-priming hand pump that sets up fast and easily delivers 30 gallons per minute has recently been introduced.

This high-capacity hand pump will move water, chemicals, petroleum products, sewage; it has many uses in farming, construction, plumbing, and general industry. Because it can handle a high percentage of solids, it is good for pumping muddy water, slurries and septic tanks. For corrosive use such as fertilizer or acid transfer, the pump can be furnished with an interior plastic coating at slight extra cost.

The new product is of cast aluminum with Neoprene diaphragm and valves. It weighs 20 lbs., including handle and base.—Protek Specialty Co.

**Circle No. 810 on Reader Service Card**

## Low Cost Water Testing Kit

A compact and low cost water testing kit has been announced by this manufacturer of domestic and industrial water softeners. It is recommended for use by plumbers, well drillers, contractors and home owners.

The new kit contains everything needed for easy and accurate testing of water for hardness, acid (pH) and iron content. Contained in a compact plastic case are: six 1¼ oz. plastic bottles of chemicals with plastic droppers and caps, three test tubes, one measuring vial and complete easy-to-follow testing instructions.—Sequestrator Products Corp.

**Circle No. 811 on Reader Service Card**

## Backwater Valve With Automatic Flap and Manually Operated Gate Valve

Backwater Valve Series No. 1140-ZZ, offered by this manufacturer, provides two important protective features: an automatically operating flap valve and a manually operated gate valve.

Vanes on the flap valve are designed so that the water will spin the flap to clean the seat. Gate valve is spade shaped so that it will cut through sewage and debris.

The automatic flap valve in the new Backwater Valve closes at the slighest backflow and prevents water from backing up into basements from overloaded sewers during sudden storms. If protection is desired during long periods of time, the manually operated gate valve is closed until waste lines to sewers can be used agains.—Josam Manufacturing Co.

**Circle No. 812 on Reader Service Card**

## Single-Stage, Double-Suction Pumps

Two new designs of double-volute, single-stage centrifugal pumps have been announced by this manufacturer. Both designs incorporate an axially split case that provides for unusually easy access. Neither suction nor discharge piping need be removed and bearings, packings, seals and the impeller can all be reached in minutes. NPSH is minimum.

Type DS is a water-cooled unit produced in 22 sizes in capacities up to 13000 gpm with a 375 foot differential head. It operates up to 350° F. Type DL is an air-cooled unit produced in 13 sizes in capacities up to 6000 gpm with a 375 foot differential head. It operates up to 250° F.—Pacific Pumps, Inc.

**Circle No. 813 on Reader Service Card**

## Right Angle Pump Drives

A release from this manufacturer announces an important broadening of its line of right angle pump drives. The product line will be marketed under the trade name "PumpMaster".

A complete and comprehensive choice of HP ratings, frame sizes and optional features provide maximum flexibility and selectivity to fit any job with custom-engineered precision. Fulfilling higher performance needs, a number of improvements have been incorporated in the new drives. Principal among these are: greater rigid strength of housing, carrier and support elements, widely-spaced anti-friction bearings, spiral bevel gearing, and straddle pinions for optimum gear and bearing alignment.—Industrial Products Div., Western Gear Corp.

**Circle No. 814 on Reader Service Card**

## Penetrant Frees Rusted "Frozen" Fittings

"Rust Buster" is the trade name of an all-new penetrant in convenient plastic squeeze bottle offered by this manufacturer. An important feature is the extending spout to place rust-freeing liquid right on the desired spot. Available in 4 ounce container, "Rust Buster" is safe for skin, clothes, metal, etc. Contains no acid, alkali or other harmful ingredients. It quickly loosens rusted bolts, screws, shafts, piping and all types of "frozen" connections and assemblies.—Armite Laboratories.

**Circle No. 815 on Reader Service Card**

## Shear-Air Valve

A new, easy-to-handle Shear-Air valve that delivers a powerful air blast with light finger pressure is on the market.

The body, nozzle and plunger of the Shear-Air valve is nickel plated bronze. The high chrome steel ball is resistant to wear and corrosion assuring tight shut-off.

The Shear-Air measures 4 inches, weighs 5 ounces. The body is tapped for ¼ inch standard pipe thread and a snap-on hook is provided for hanging.—General Kinetics Corp.

**Circle No. 816 on Reader Service Card**

## Jack-Leg Trencher

It has been announced that the Jack—Leg Ditch Witch trencher is now available in 9 hp and 12 hp sizes mounted on rubber tires. The first will dig trench from 3 in. to 8 in. wide to depths of 4 ft, and the second will dig trench 3 in. to 12 in. wide to 5 ft in depth.

This machine has been developed for use in installation of underground street lighting cables where it is desirable to trench the cable close to the curb. The jack is so installed on the trencher that one wheel may be lowered as much as 12 in., so that the machine may be maintained on a vertical plane while the wheels are driving on two different levels. This new trencher is also very adaptable to work where trench is being dug on terraces or side hill slopes.—Witch Marketing Co.

**Circle No. 817 on Reader Service Card**

## Curing and Hardening Compound

A new product, identified as "Cure-Hard," specifically developed to cure, chemically harden, seal and dust-proof concrete in one operation, has been announced by this manufacturer.

It is recommended for curing exposed floor slabs, walls, beams, columns, sidewalks, etc. It also provides a hard, dust-free surface on all concrete floor slabs to be covered by resilient floors. Assures a perfect base for adhesion of linoleum, asphalt, vinyl and rubber tile. Equally adaptable to old concrete for sealing and dust-proofing.—W. R. Meadows, Inc.

**Circle No. 818 on Reader Service Card**

CONTINUED ON PAGE 84A


*Another Reason You're Money Ahead With*

**Verti-Line Pumps**

**LARGER-Than-Standard Shafting Minimizes "TWIST-OFFS", LENGTHENS PUMP LIFE!**

When you specify Layne & Bowler "Verti-Line" Pumps you are buying pumps built to standards far beyond those used for conventional vertical turbine pumps. For example, in "Verti-Line" Pumps tougher, longer-lived "Moly" Iron is standard construction *at no extra cost*. The unique Perihedral 2-Way Pump Seal is another extra-performance feature built into every "Verti-Line" Pump. And still another is the much heavier pump shafting used in all "Verti-Line" Pumps...

**The Pump Shaft in a vertical turbine pump is one of those critical parts you can't see—but its size and construction mean a lot in the performance you get. The pump shafts in "Verti-Line" Pumps are not only made of carefully-selected alloy steel—the best available for the purpose—but are also considerably larger in cross section than are the shafts used in most other pumps.**

Larger pump shafting means larger bearing surfaces, a steadier-running pump, and much less risk of "twist-offs" or maintenance problems when sudden loads are placed on the impellers—or when the impellers strike debris in the fluid being pumped. This is one more of the many hidden "extras" you get when you specify Layne & Bowler "Verti-Line" Pumps—the pumps that are built *up* to performance, not down to competition. Yet you pay no more for the extra values built into "Verti-Line" Pumps. In fact, you actually pay *less* because of the longer life and lower maintenance these quality pumps provide!

"Verti-Line" Pumps are available in a complete range of sizes...20 to 10,000 GPM—1½ to 1000 H.P.—Heads to 650 ft.

Send for "Verti-Line" Bulletin #1100 that gives helpful details on these advanced vertical turbine pumps!

*Verti-Line Pumps are the exclusive products of*

**LAYNE & BOWLER PUMP COMPANY**
**LOS ANGELES 22**

New York 20, N.Y. • Chicago 4, Ill. • Hastings, Neb. • Monroe, La.
Farwell, Texas • Twin Falls, Idaho • Fresno, Calif.

# ON GUARD IN INDEPENDENCE SQUARE

About 75 feet away from Independence Hall, in the park to the south, stand R. D. Wood Hydrants like sentinels on duty. While their proximity to the Nation's most revered historic monument does not necessarily imply endorsement, we nevertheless like to think of them there, on guard night and day against the fire that could destroy what Gen. Howe saw fit to spare, and Clinton too, in the British occupation. But R. D. Wood Hydrants need no endorsement. For over a century they have shown themselves to be in constant readiness for any emergency. Of simple, ingenious design and rugged construction, R. D. Wood Hydrants are protected against ice and sediment—function smoothly when the engines arrive. There could be no better protection for any community than R. D. Wood Hydrants—and there could be no better protection for the birthplace of the U.S.A.

**Conform to A.W.W.A. specifications**

**R. D. WOOD COMPANY**

***Established in 1803***

**Public Ledger Bldg.**
**Independence Square**
**Philadelphia 5, Pa.**

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds)

P. H. Van Orden, President, C. L. Peterson, Vice-President and Treasurer, and R. H. Webb, Foreman of the Van Orden Company, Contractors, of Grand Rapids, Mich., supervise the installation of "K&M"® Asbestos-Cement Sewer Pipe at Paw Paw, Mich.

10,000 FT. OF SEWER PIPE LAID...

# . . . not enough infiltration to measure

Read how the Van Orden Company solved the problems of installation and of infiltration when pipe had to be laid 9 ft. below the water table.

# "the ease of handling and assembly saved us dollars and time!"

P. H. Van Orden

"Construction of the Paw Paw trunk sanitary sewer called for installation of pipe at depths up to 19 feet, where water table was at 10 feet. Infiltration had been the major problem in other sewer installations in the area. We solved this problem by using "K&M" Asbestos-Cement Sewer Pipe with its FLUID-TITE joint. With 10,000 feet of sewer in, we haven't had enough infiltration to measure.

"The longer laying lengths and the speed with which a joint can be made are definite time-saving factors, which have added to our production. Less time spent grading pipe and handling material means dollars saved."

Rigorous tests prove "K&M" Asbestos-Cement Sewer Pipe is infiltration-tight at 25 psi . . . a pressure equivalent to that of a 58-foot head of water.

"K&M" Asbestos-Cement Sewer Pipe wont rust, rot, or corrode. Its smooth bore remains clean, permanently. Flatter grades are possible. Fewer lift stations are required.

Maintenance-wise, the village of Paw Paw, Mich., will enjoy tax savings. "K&M" Asbestos-Cement Sewer Pipe is practically indestructible. Requires fewer inspections, because root growths do not penetrate the exclusive FLUID-TITE coupling.

Write today for more information on "K&M" Asbestos-Cement Sewer Pipe to: Keasbey & Mattison Company, Ambler, Pa.

## Keasbey & Mattison at Ambler

K·M
BEST IN ASBESTOS

Two-step assembly! Lubricate the tapered end of "K&M" Asbestos-Cement Sewer Pipe, then slide it into the exclusive, patented "K&M" FLUID-TITE® Coupling.

Light weight reduces shipping and handling costs...saves on installation time. At the same time, there's a minimum of wastage and breakage on the job, with tough "K&M" Asbestos Sewer Pipe.

# 95% SPACE SAVINGS for sewage plants

COMPARATIVE SPACE REQUIREMENTS
(Based on data in FISWA Manual of Practice No. 8, 1959)

| Population | Average area for open sand beds (square feet) | Average area for complete vacuum filter installation (square feet) |
|---|---|---|
| 10,000 | 17,500 | 950 |
| 20,000 | 35,000 | 1,400 |
| 30,000 | 52,000 | 1,900 |
| 40,000 | 70,000 | 2,250 |
| 50,000 | 87,500 | 2,650 |
| 100,000 | 175,000 | 3,500 |

**Vacuum filters using Pennsalt Ferric Chloride** to get faster coagulation—and denser, drier filter cake—require as little as 5% of the area of open sand beds. And labor costs are lower . . . odor problems eliminated . . . peak loads more readily handled.

Plan to use this modern method of filtration in your new plant. We will be glad to share with you and your consulting engineers our 30 years of experience with ferric chloride. Write Industrial Chemicals Division, PENNSALT CHEMICALS CORPORATION, Three Penn Center, Phila. 2, Pa., 2901 Taylor Way, Tacoma 2, Wash.

**For dependable water treatment,** use Pennsalt Water Works Grade Chlorine.

*See our complete listing in Chemical Materials Catalog*

**Industrial Chemicals Division**

SALES OFFICES: APPLETON • ATLANTA • CHICAGO • DETROIT
LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH
PORTLAND • ST. LOUIS • SAN FRANCISCO • TACOMA

FOREIGN SALES: INDUSTRIAL QUÍMICA PENNSALT, MEXICO CITY
PENNSALT INTERNATIONAL, PHILADELPHIA, PA.

**Pennsalt Chemicals**
ESTABLISHED 1850

# Meetings

## WHAT WHEN WHERE

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Aug. 20-25—Blacksburg, Virginia (Virginia Polytechnic Institute) Annual short school for water works, sewerage and industrial wastes personnel. Write: Prof. W. A. Parsons, Sanitary Engineering, Holden Hall, Virginia Polytechnic Institute, Blacksburg, Va.

Aug. 21-25—Raleigh, North Carolina (North Carolina State College) Water Works School. Sponsored By North Carolina Section A.W.W.A., North Carolina Leage of Municipalities, North Carolina State Board of Health.

Aug. 21-25—Neosho, Missouri (Water & Sewerage Technical School) Short Course: Sewerage Works Course No. 1. Write: Lloyd Caughran, Director, Water & Sewerage Technical School, Box 348, Neosho, Mo.

Aug. 27-31—St. Louis, Missouri (*Sheraton-Jefferson Hotel*) AMERICAN SOCIETY OF SANITARY ENGINEERING.

Synchro-Start's new protective engine controls have been designed, for the starting and stopping of engines from remote pilot devices, such as pressure switches, float switches, power failure relays, etc., and are completely automatic in operation. These dependable controls are encased in a steel, dust proof cabinet, and now feature enclosed PLUG-IN RELAYS as well as OVERLOAD BREAKERS. The plug-in relays simplify what little field maintenance that may have been required in older models, while the overload breakers eliminate the necessity of replacing fuses.

In designing this unit we have used the same high quality materials and workmanship that our customers have come to expect throughout Synchro-Start's 27 years of manufacturing engine controls.

SYNCHRO-START PRODUCTS, INC.


Sept. 3-8—Chicago, Ill. AMERICAN CHEMICAL SOCIETY, Div. of Water and Waste Chemistry.

Sept. 11-13—Louisville, Kentucky (*Brown Hotel*) KENTUCKY-TENNESSEE SECTION A.W.W.A. Secy., Harold F. Mount, Preston Street Road Water Dist. No. 1, 5400 Preston Highway, Louisville, Ky.

Sept. 11-13—Louisville, Ky. (*Brown Hotel*) KENTUCKY-TENNESSEE INDUSTRIAL WASTES & SEWAGE WORKS ASSN. Secy., S. Leary Jones, 602 Cordell Hull Bldg., Nashville 3, Tenn.

Sept. 12-Oct. 5—New Brunswick, N. J. (*Rutgers University*) Short Course: Water Works and Filter Plant Operation. Contact Dean, College of Engineering, Rutgers, the State University, New Brunswick, N. J.

Sept. 13-15—Saranac Lake, N. Y. (*Saranac Inn*) N.Y. SECTION A.W.W.A. Secy., Kimball Blanchard, Neptune Meter Co., 2222 Jackson Ave., Long Island City 1.

Sept. 13-15—St Paul, Minn. (*Hotel Lowry*) NORTH CENTRAL SECTION A.W.W.A. Secy., Carl A. Flack, Water Dept., 216 City Hall, St. Paul 2, Minn.

Sept. 17-21—Poland Spring, Maine. Annual Convention NEW ENGLAND WATER WORKS ASSOCIATION.

Sept. 18-22—Neosho, Missouri (Water & Sewerage Technical School) Short Course: Water Works No. 1. Write: Lloyd Caughran, Director, Water & Sewerage Technical School, Box 348, Neosho, Mo.

Sept. 20-22—Atlanta, Ga. (Ga. Institute of Technology) GA. WATER & SEWAGE ASSN. Secy., Robert S. Ingols, Prof. of Applied Biology, Ga. Institute of Technology.

Sept. 20-22—Rapid City, South Dakota (*Sheraton-Johnson Hotel*) JOINT MEETING SO. DAK. WATER & SEWAGE WORKS CONF., SO. DAK. SECTION A.W.W.A. and SO. DAK. WATER POLLUTION CONTROL ASSN. Secy., Don C. Kalda, So. Dak. Water and Sewage Works Conf., Div. of San Engrg., State Board of Health, Pierre, So. Dak.

Sept. 24-27—Lake Placid, N. Y. AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

Sept. 24-27—Minneapolis, Minn. (*Municipal Auditorium*) PUBLIC WORKS CONGRESS & EQUIPMENT SHOW. Write: American Public Works Assn., 1313 E. 60th St., Chicago 37, Ill.

Sept. 27-29—Milwaukee, Wis. WISCONSIN SECTION A.W.W.A. Fortieth Annual Conf. Secy., Harry Breimeister, 507 Municipal Bldg., 841 N. Broadway, Milwaukee 2, Wis.

Sept. 28—CONNECTICUT A.W.W.A. Secy., D. W. Loiselle, Supt. of Supply, Bridgeport Hydraulic Co., 835 Main St., Bridgeport.

Oct. 1-3—Springfield, Missouri (*Kentwood Arms Hotel*) MISSOURI SECTION A.W.W.A. Secy., Warren A. Kramer, Chief, Water Supply, Div. of Health, State Office Bldg., Jefferson City.

Oct. 1-3—Springfield, Missouri (*Kentwood Arms Hotel*) MISSOURI WATER POLLUTION CONTROL ASSN. Secy., Jack K. Smith, Old Post Office Bldg., 112 W. High, Jefferson City, Mo.

Oct. 2-3—Moncton, New Brunswick (*Brunswick Hotel*) MARITIME BRANCH, CANADIAN SECTION A.W.W.A. Secy., J. Douglas Kline, Public Service Commission, P. O. Box 608, Halifax, N. S.

CONTINUED ON PAGE 82A

"from Chicago"

# CLOG-PROOF SHEARFUSER† DIFFUSERS FOR CONTINUOUS DIGESTER MIXING

## Eliminates Equipment Removal for Servicing

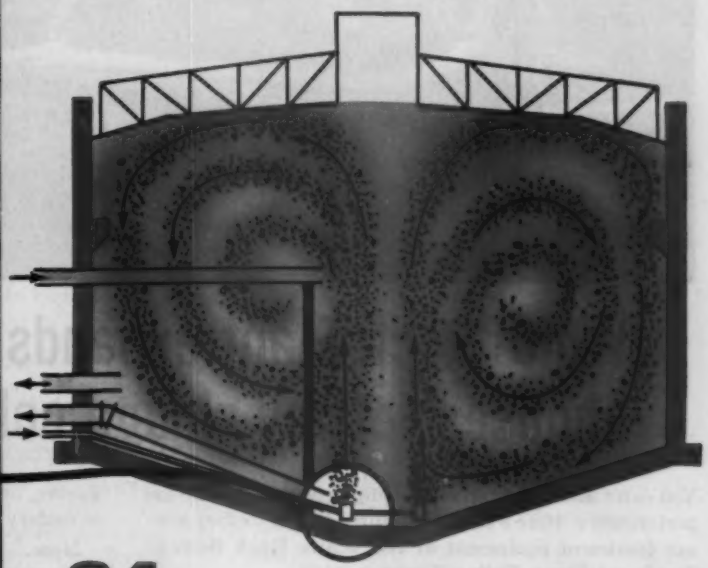
Hydroshear action in Shearfuser gas diffusers providing benefit of fine bubble diffusion from clog-proof nozzle.

**EXCLUSIVE BENEFITS OF SHEARFUSER DIFFUSERS**

1. Self-cleaning during gas flow.
2. Total digester contents mixed by installation on tank bottom.
3. No interruption of digester operation.
4. Increased mixing rate from fine bubbles induced by Hydroshear action.

### *CRP Accelerated Sludge Digestion System**

Reduces tank volume required by high sludge loading rate. Produces homogeneous sludge through continuous mixing.



**64** operating and specified installations of the CRP System* with "Chicago" gas mixing equipment since 1952 prove its unparalleled acceptance . . . servicing cities from 2000 to 250,000 population.

***System license under U. S. Patent No. 2777815 and foreign patents available.**

†Pat. Pending

*Putting Ideas to Work*

FOOD MACHINERY AND CHEMICAL CORPORATION
HYDRODYNAMICS DIVISION
**CHICAGO PUMP**
422H DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

*Consultants, Powell & Powell*

# White Rock Plant expands again... chooses Jeffrey sludge collectors again

You can't find better proof of equipment than on-the-job performance. Here's the record turned in by Jeffrey sewage treatment equipment at the White Rock Sewage Treatment Plant, Dallas, Texas.

In 1939, sludge collectors for two Jeffrey primary tanks and three secondary tanks were installed. 1948—two Jeffrey mechanical-cleaned bar screens, screenings grinder, two grit collectors, and spiral and scraper collectors were installed.

In 1951, more Jeffrey equipment: mechanical-cleaned screens, belt conveyors, grinders, grit collectors, grit washer, and sludge collectors for two primary and two secondary tanks.

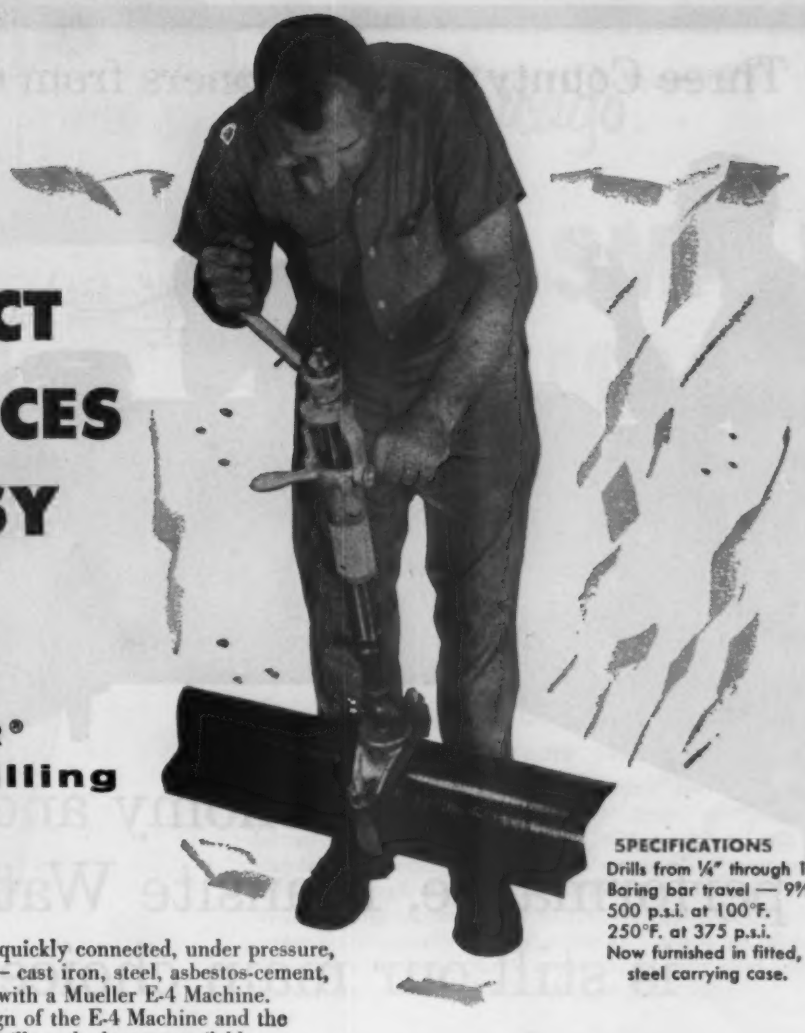
Now . . . 1961 . . . installation is underway for four new primary tanks and two secondaries equipped with Jeffrey sludge collectors. More examples of the way Jeffrey equipment proves itself again and again.

Jeffrey sanitation engineers can advise you on equipment to suit your conditions. Get your copy of Bulletin 952 describing Jeffrey equipment for water, sewage and industrial waste treatment. Write The Jeffrey Manufacturing Company, 996 North Fourth St., Columbus 16, Ohio.

*If it's conveyed, processed or mined, it's a job for Jeffrey.*

JEFFREY

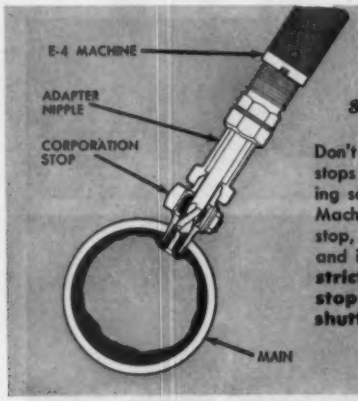
# CONNECT SERVICES THE EASY WAY!



## MUELLER® E-4 drilling machine

**SPECIFICATIONS**
Drills from ¼" through 1"
Boring bar travel — 9⅛"
500 p.s.i. at 100°F.
250°F. at 375 p.s.i.
Now furnished in fitted, steel carrying case.

**S**ervice lines are easily and quickly connected, under pressure, to any type of main — cast iron, steel, asbestos-cement, cement-lined or concrete — with a Mueller E-4 Machine. The simple, rugged design of the E-4 Machine and the great variety of drills and adapters available make it an extremely useful water works tool. Write for complete information.




### *clean corporation stops under pressure!*

Don't abandon clogged corporation stops when cleaning mains and replacing service lines. Simply attach the E-4 Machine to the outlet of the installed stop, open stop, and drill out all deposits and incrustations as shown. **Full unrestricted flow of the corporation stop is quickly restored without shutting off the main.**

### *Just follow these simple steps:*

1. Bolt a Mueller Service Clamp to main in desired position.
2. Install a Mueller Corporation Stop in clamp and open stop.
3. Attach E-4 Machine directly to outlet of corporation stop by using adapter nipple.
4. Advance drill through both open stop and clamp and drill into main.
5. Withdraw drill and close corporation stop.
6. Remove "E-4" and attach service piping to outlet of stop.

**MUELLER CO.**
**DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles; in Canada: Mueller, Limited, Sarnia, Ontario

# Three County Commissioners from Ohio report:

## "For economy and performance, Transite Water Pipe is still our main choice."

*Belmont County, Ohio, Commissioners William H. Dorsey, Austin C. Furbee and Louis T. Salvador.*

"Belmont was one of the many counties that experienced a building and population boom. Fortunately, our officials had the foresight to recognize its ultimate effect on our water system and service. As early as 1953, plans were made to meet future demands. Surveys were made . . . operating men and engineers were consulted . . . pipe materials investigated.

"In 1956, we extended our water system 13 miles. The installation and operating economies are now a matter of record. The successful performance of the extension is attributed to careful planning, helpful advice and, in part, to the selection of Transite Pipe.

"When we began designing another expansion of the system for 1960, our previous experience made Transite the main choice. The Belmont Water System now has 53 miles of Transite installed in rocky terrain and corrosive soils. The excellent performance of the first 13-mile section leads us to believe that Transite will provide economical maintenance and operation for many years."

For the full Transite® story, write Johns-Manville, Box 14, WS-8, New York 16, N. Y. In Canada: Port Credit, Ontario. Cable address: Johnmanvil.

JOHNS-MANVILLE PRODUCTS

JOHNS-MANVILLE
TRANSITE PIPE
THE WHITE PIPE THAT PROTECTS PRICELESS WATER

"from Chicago"

# A SMALL COMPACT 4 inch COMMINUTOR

**Reverse cutting 4R Comminutor for packaged sewage treatment plants and pump stations.**

The NEW 4R Comminutor screening and comminuting machine, smallest (25" high with 4" drum) of those manufactured by Chicago Pump is a self contained unit with stainless steel cutting teeth and comb. This new reverse cutting concept of comminution provides increased sewage solids cutting capacity. The cutting teeth, driven by a ¼ hp motor automatically cuts all solids in the sewage inlet line. The unit with its adaptable mounting fits any inlet line and can be easily removed without pipe disturbance.

Write for Bulletin 184

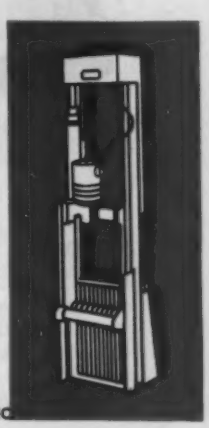
## LARGER COMMINUTING MACHINES

### THE ORIGINAL COMMINUTOR

The original Comminutor, developed by Chicago Pump provides continuous screening and cutting of coarse sewage matter for use in hydraulically designed feeder basins. Sized for flows of .175 to 25 MGD per machine.

### MODEL "C" BARMINUTOR MACHINE

Model "C" Barminutor—reversible screening and comminuting machine for channels 1 to 3 feet wide. Outstanding features include single motor drive counterweighted for extended life, stainless steel screen, ball bearing shoes and reversible cutting for increased cutting action and cutter life.



*Putting Ideas to Work*

FOOD MACHINERY AND CHEMICAL CORPORATION
HYDRODYNAMICS DIVISION

**CHICAGO PUMP**

622H DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

© 1961 CP-FMC

*"Could you fetch it*
*a little quicker Gran'maw*
*Tyton lays mighty fast y' know"*

**U.S.** cast iron **PIPE** FOR WATER, SEWERAGE AND

# stays ahead of the job

No need for your ditcher to dally . . . . .

Tyton Joint* pipe keeps pace . . . stays right with your laying crew. Even in rain or wet trench. "Tyton" is so simple, so easy to handle. Only one accessory needed—a rubber gasket. No bell holes, nuts, bolts or caulking equipment.

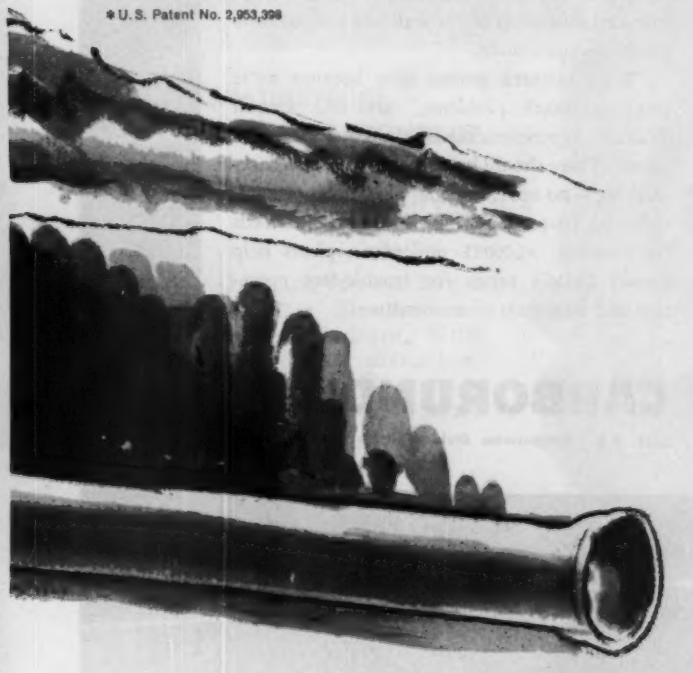
"Tyton" goes in fast . . . cleans up fast. And **you** get the benefit—lower costs, more lengths laid per man.

Get the full, money-saving story today.
Call or write:

**U. S. PIPE AND FOUNDRY COMPANY**
General Office: Birmingham 2, Alabama

A Wholly Integrated Producer from Mines and Blast Furnaces to Finished Pipe.

*U. S. Patent No. 2,953,398

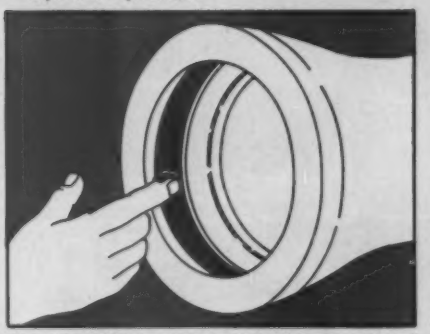


INDUSTRIAL SERVICE CAST IRON

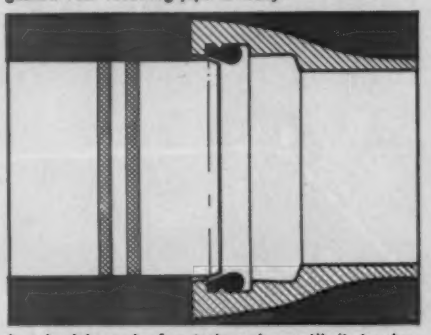
## TYTON®

### ONLY FOUR SIMPLE ACTIONS

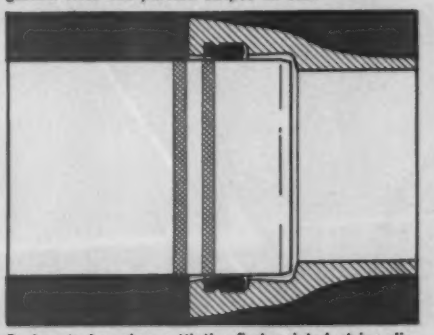
Insert gasket with groove over bead in gasket seat . . . a simple hand operation.



Wipe film of Tyton Joint® lubricant over inside of gasket. Your receiving pipe is ready.



Insert plain end of entering pipe until it touches gasket. Note two painted stripes on end.



Push entering pipe until the first painted stripe disappears and the second stripe is approximately flush with bell face. The joint is sealed . . . bottle-tight, permanently! The job's done . . . . fast, efficiently, economically. Could anything be simpler?

City of Kaufman, Texas,
Water Treatment Plant shows

# Simplified installation of porous plate underdrains for long, trouble-free service

The nearly completed porous plate bottom shows how the City of Kaufman, Texas, planned for maximum simplicity of construction and freedom from water filter problems.

The plates are ALOXITE® aluminum oxide, laid on concrete piers with the hold-down bolts embedded during construction. Plates are fitted with a synthetic plastic gasket manufactured by Christy Firebrick Co., 506 Olive St., St. Louis, Missouri. No jointing is required. When the hold-down bolts are tightened, a bead around the gasket insures a tight, continuous seal. Angle iron at the junction of the wall and bottom completes the installation.

"With ALOXITE porous filter bottoms we're avoiding future problems," says Mr. Carroll Wallace, Superintendent of the water treatment plant. "There should be no difficulties with backwashing — no upset beds, no blow holes or mudballs, no frequent pulling down of filter beds for cleaning. ALOXITE underdrain plates help answer today's needs for trouble-free operation and minimum of maintenance."

**CARBORUNDUM®**

Dept. X-81, Refractories Division, Perth Amboy, N. J.

# MUELLER®

## AWWA IMPROVED FIRE HYDRANTS

**BRONZE WEATHER CAP**—Keeps water away from operating nut and prevents tampering.

**OIL FILLER PLUG**—Check oil level quickly without removing bonnet.

**OIL RESERVOIR**—Automatically lubricates stem threads and bearing surfaces.

**DRY TOP DESIGN**—Threads and bearing surfaces are sealed from water.

**"O" RING SEALS**—Permanent, watertight, adjustment-free seal without binding.

**BREECH-LOCKED NOZZLES**—Interlocked and calked to prevent blow-out.

**NON-KINKING CHAINS**—Attached under each individual nozzle.

**SAFETY STEM COUPLING**—Breaks apart without bending the stem. Repaired in minutes without digging and with no loss of water.

**SAFETY FLANGE**—Separates cleanly on impact to prevent damage to barrel. Can be restored without shutting off water.

**COMPRESSION-TYPE MAIN VALVE**—Positively closed by water pressure. Of special wear and damage-resistant material. Permits repairs without shutting off water.

**BRONZE SEAT RING**—Straight threads, with copper-asbestos gasket, permits easy removal.

**DOUBLE DRAIN VALVES**—Empty barrel completely. Flushed with each use.

**BRONZE CAP NUT**—Locks stem and seals threads against corrosion.

**WEATHERPROOF**
**. . . TAMPERPROOF**
**. . . TRAFFICPROOF**
**. . . MAINTENANCE-FREE!**

Once set, you can forget about a Mueller Improved Hydrant. With little or no attention, the Mueller Hydrant is ready for action in any weather.

Write for complete information and specifications.

MUELLER CO. Since 1857 SERVING the Water and Gas Industries QUALITY 06273

**MUELLER CO.**
**DECATUR, ILL.**

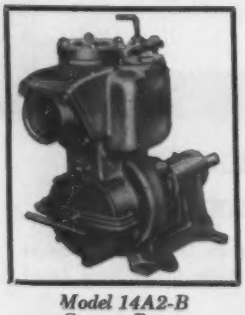
Factories at: Decatur, Chattanooga, Los Angeles
In Canada: Mueller, Limited, Sarnia, Ontario

*End Plate off*

*Towel out*

*End Plate on*

"Towels can jam the works, but good!" says Cecil Kent, owner, Sanitation Service Company, Jacksonville, Florida, "I've had 'em clog conventional pumps so bad, it meant a shutdown from two hours to two days.



*Model 14A2-B Sewage Pump*

"That's why I've standardized on Gorman-Rupp sewage pumps. And what a difference! Fewer shutdowns . . . clogging cleared in just three to fifteen minutes! This cuts average maintenance costs from $120 to only $12 per pump per year. On my 21 Gorman-Rupp pump installations, that adds up to a whopping big saving. Over $2200 a year on parts, packing, materials, and labor.

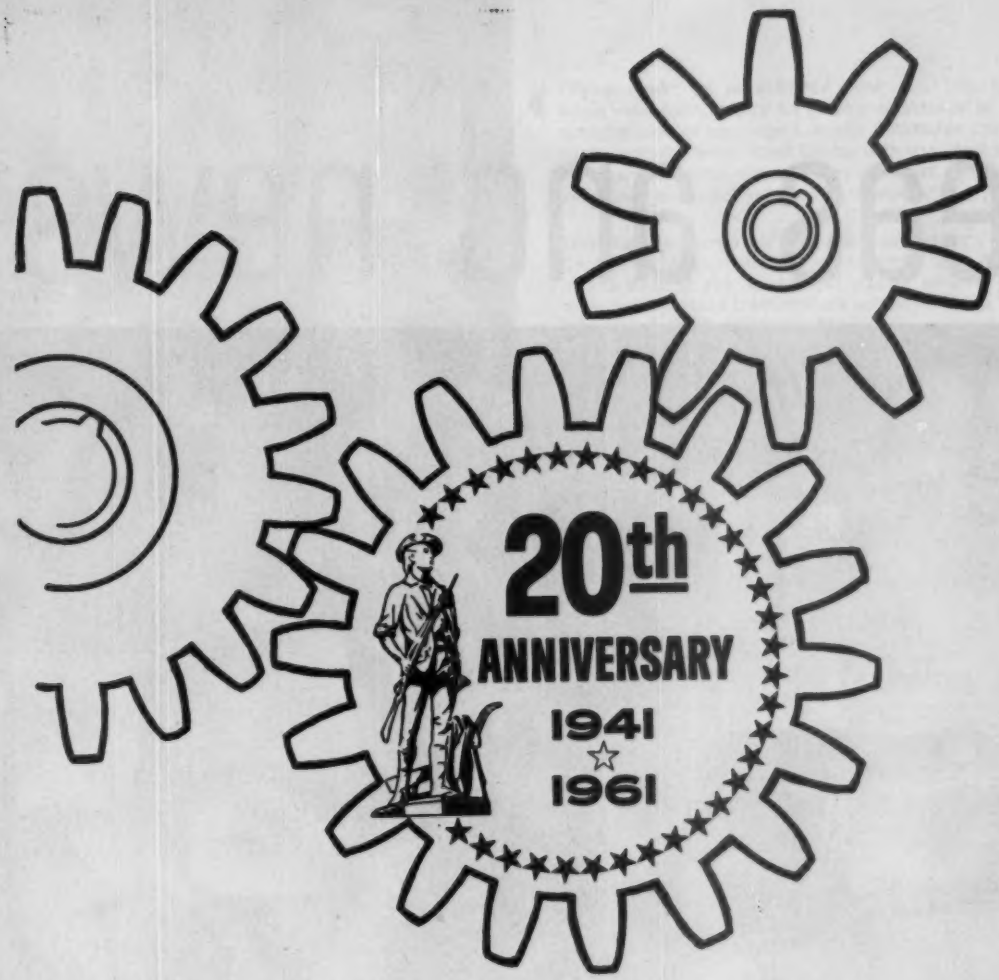
"Sure, I had a problem—but *no more!*"

Thrifty, trouble-free, self-priming Gorman-Rupp sewage pumps —2", 3", 4" or 6" sizes—can be connected to your power or ordered complete with power units. Write for complete specifications.

**THE GORMAN-RUPP COMPANY**

**305 Bowman Street** **Mansfield, Ohio**

**Gorman-Rupp of Canada Ltd., St. Thomas, Ontario**




**AT THE HEART OF THINGS**

This 20th anniversary of the U. S. Savings Bonds program is an important milestone for the 45,000 companies, large and small, which offer the Payroll Savings Plan to their employees. Payroll Savings is the heart of the bond program, and the means by which millions of families have seen dreams realized since 1941. It has been good for business and industry... good for local communities... good for the nation's economic welfare. Above all it is good for the citizen who sees in each Savings Bond a share in his country's future.

If yours is one of the 45,000 participating companies, this anniversary year offers a good reason for renewed promotion. For help and suggestions, contact your State Savings Bonds Director, or write: **U.S. Savings Bonds Division, Treasury Department, Washington 25, D.C.**

**U.S. SAVINGS BONDS DIVISION—**
**20 YEARS OF SERVICE TO AMERICA**

**WATER & SEWAGE WORKS Magazine**

The U. S. Government does not pay for this advertisement. The Treasury Department thanks, for their patriotism, The Advertising Council and the donor above.

# ideas and news:

**More hp in a smaller package** . . . Redesign of the Allis-Chalmers hollow-shaft motor has resulted in a more compact unit. New, attractive styling makes it an asset to any pump installation. Oil-lubricated guide and thrust bearings, large accessible oil-fill holes, and easily readable oil level gauges simplify maintenance. Double end ventilation and fully guarded openings assure trouble-free service.

**Control centers cut costs** . . . You save space, simplify wiring and reduce inspection and maintenance expenses with new Allis-Chalmers low-voltage motor control centers. Plug-in terminal blocks and drawout construction cut inspection time by making it quick and easy to withdraw or remove control units. Pushbuttons and pilot lights are mounted on the removable frames to eliminate failures common with hinged wiring. Special connectors make it impossible for bus connections to loosen. Extra-heavy bus bracing makes additional bracing unnecessary when you add capacity.

## Which of these productive ideas could be working for you?

A motor control center that simplifies maintenance. A valve that offers zero flow resistance. A more compact transformer. These examples demonstrate the extra value that is standard with A-C . . . the greater efficiency and added productivity which are yours when you buy A-C products, systems and services. Call your Allis-Chalmers representative for details on A-C "worth-more" features. Or write Allis-Chalmers, Industries Group, 904 South 70th Street, Milwaukee 1, Wisconsin.

Rotovalve is an Allis-Chalmers trademark. A-1458

**"Open road" for unrestricted flow . . . This ROTOVALVE, when wide open, offers no greater resistance to flow than a straight pipe of equivalent length. Promotes lower pumping costs. Actually seats itself tighter with use. And special shut-off characteristics reduce water hammer. All moving parts are totally enclosed, yet easily accessible.**

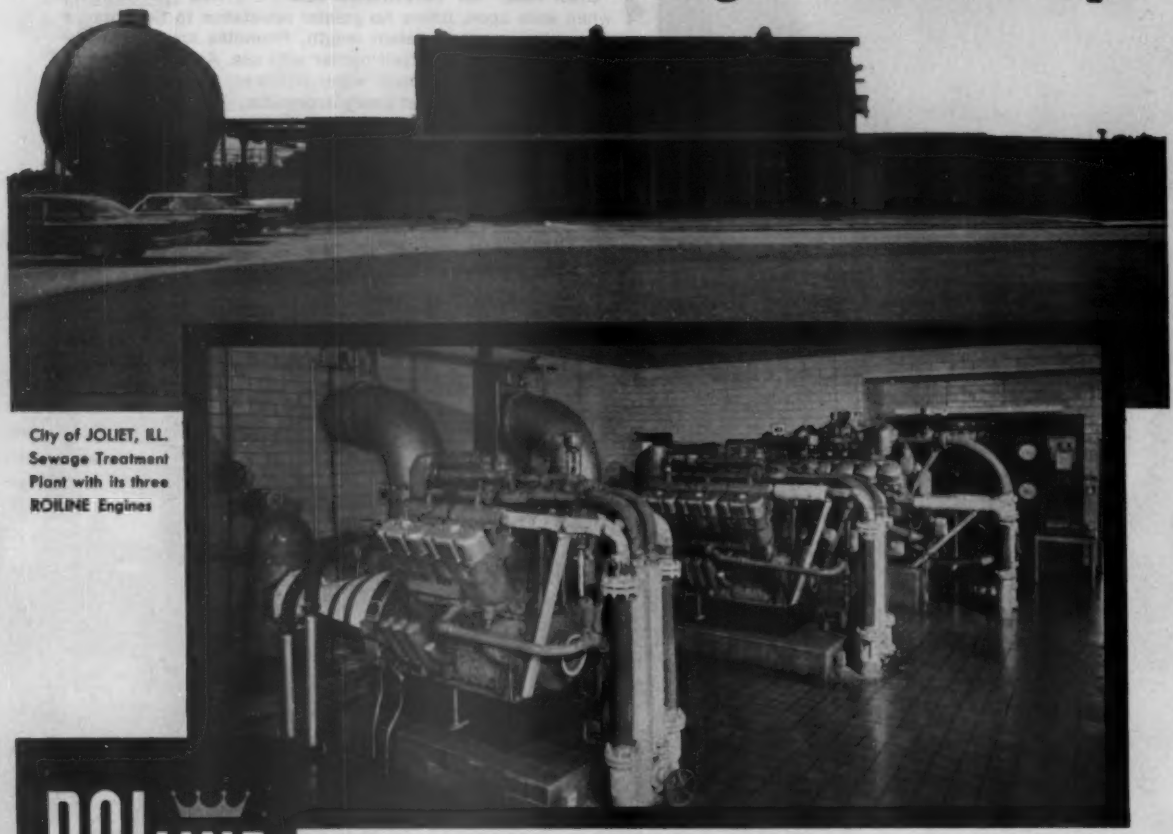
**Transformers "grow up" but don't get bigger . . . New Allis-Chalmers transformers deliver as much as a 30% increase in kva without any increase in size or weight. This permits replacement of old transformers without altering base mountings or overhead structures. The unit being installed has twice the rating of the neighboring 2500-kva transformer.**

**Stainless steel "scorns" corrosion . . . It's standard with all Allis-Chalmers tray-type deaerator internals. This 90,000 lbs. per hour "package" unit removes oxygen and other corrosive gases besides heating boiler feedwater. Heating and distributing tray design provides greater spillage edge — extra-efficient air separating trays remove more oxygen and gases through full counterflow design. Protects boiler and associated steam and condensate equipment from corrosive attack.**

**ALLIS-CHALMERS PRODUCTS:** Look to Allis-Chalmers for compressors; controls; coolers; crushers; earth-moving equipment; engines; generators; industrial systems; kilns; lift trucks; motors; pumps; rectifiers; screens; electrical generation and distribution equipment; tractors; transformers; unit substations; valves; water conditioning equipment.

# ALLIS-CHALMERS

# PUMPING 15 million gallons daily



City of JOLIET, ILL. Sewage Treatment Plant with its three ROILINE Engines

## ROILINE ENGINES do it *with sewage gas fuel*

Pumping fifteen to twelve million gallons! Joliet's city sewage treatment plant does it—every day.

The Worthington sewage pumps are driven through Amarillo right angle gears by ROILINE Engines *using sewage gas for fuel.*

ROILINE Model L-3000 runs *continuously,* 107 hp at 545 rpm, capacity 10,400 gpm; 12-cyl., 6¾-in. bore x 7-in. stroke, 3006 cu. in. displ.

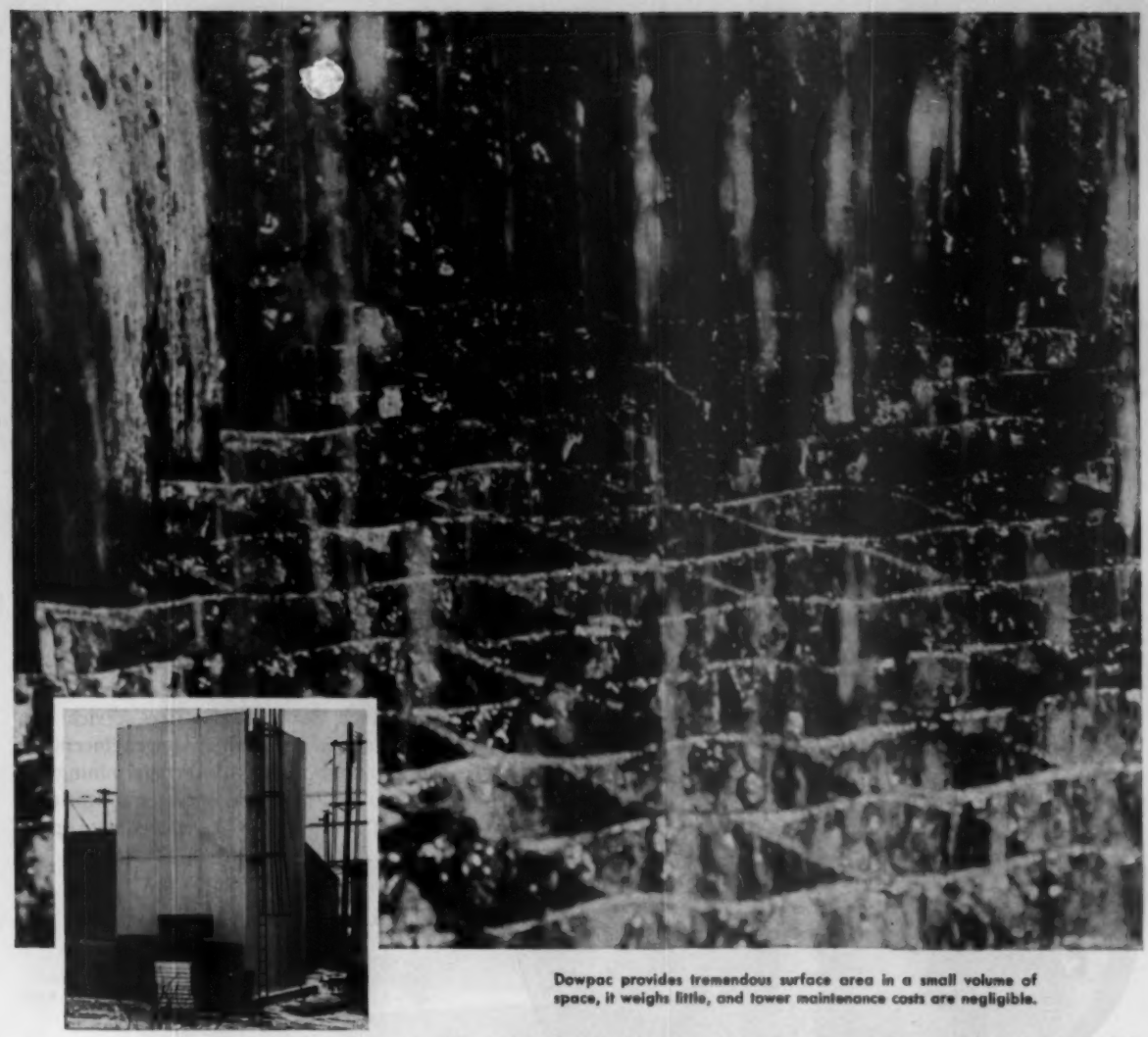
ROILINE Model H-2000 as an *auxiliary,* 75 hp at 637 rpm, capacity 7,300 gpm; 8-cyl., 6¾-in. bore x 7-in. stroke, 2004 cu. in. displ.

ROILINE Model L-3460 as a *standby,* 151 hp at 530 rpm, capacity 15,300 gpm; 12-cyl., 7¼-in. bore x 7-in. stroke, 3468 cu. in. displ.

***Send for literature*** • ***SEE YOUR ROILINE ENGINE DISTRIBUTOR*** 517

**ARIZONA,** Casa Grande, Engine Service Company, Inc.
**ARKANSAS,** Paragould, Wonder State Manufacturing Co.
**CALIFORNIA,** Long Beach and Bakersfield Engine & Equipment Company
**COLORADO,** Denver, Emrick & Hill Engine & Equipt. Co.
**KANSAS,** Garden City and Great Bend Carson Machine & Supply Co.
**LOUISIANA,** New Orleans and Shreveport Southern Engine & Pump Co.
**MICHIGAN,** Reed City, Hafer Engine Company
**MINNESOTA,** Minneapolis, Central Equipment Co.
**MISSISSIPPI,** Jackson, Southern Engine & Pump Co.
**NEW JERSEY,** Kenilworth, Callahan Equipment Co.
**NEW YORK,** Syracuse, Schenectady and Lisbon J. C. Georg Corporation
**OHIO,** Columbus, Cantwell Machinery Company
**OKLAHOMA,** Oklahoma City and Tulsa Carson Machine & Supply Co.
**PENNSYLVANIA,** Pittsburgh, P. C. McKenzie Company Bradford, R. R. Rock Company
**TEXAS,** Houston, Dallas, San Antonio, Kilgore, Corpus Christi, Beaumont Southern Engine & Pump Co.
Lubbock, Farmers Supply
Odessa, General Machine & Supply, Inc.
Wichita Falls, Nortex Engine & Equipment Co.
**WYOMING,** Casper, Emrick & Hill Engine & Equipt. Co.

**WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.** / **New York • Tulsa • Huntington Park, Calif.**
**Factories: Waukesha, Wisconsin and Clinton, Iowa**



Dowpac provides tremendous surface area in a small volume of space, it weighs little, and tower maintenance costs are negligible.

# NEW DOWPAC MEDIA TREAT SEWAGE AND WASTE FAST IN LITTLE SPACE

*. . . D.I.S. offers low-cost pilot plant to prove system for your waste conditions!*

Contoured plastic sheets of Dowpac® packing media interlock (above) to form a continuous, lightweight grid for low-cost treatment of water-borne wastes. Because of light weight and high operating efficiency, a waste treatment system using Dowpac requires much less land area for construction than other waste systems, while operating at higher waste concentrations.

**Cost advantages**—Economical first cost . . . low maintenance and operating costs . . . conserves expensive land. **Operating advantages**—large area for bacterial growth . . . efficient aeration . . . freedom from plugging. **Total advantages**—a D.I.S. waste treatment system using Dowpac costs you less to install and operate and treats more waste faster, at higher concentrations, than other kinds of systems.

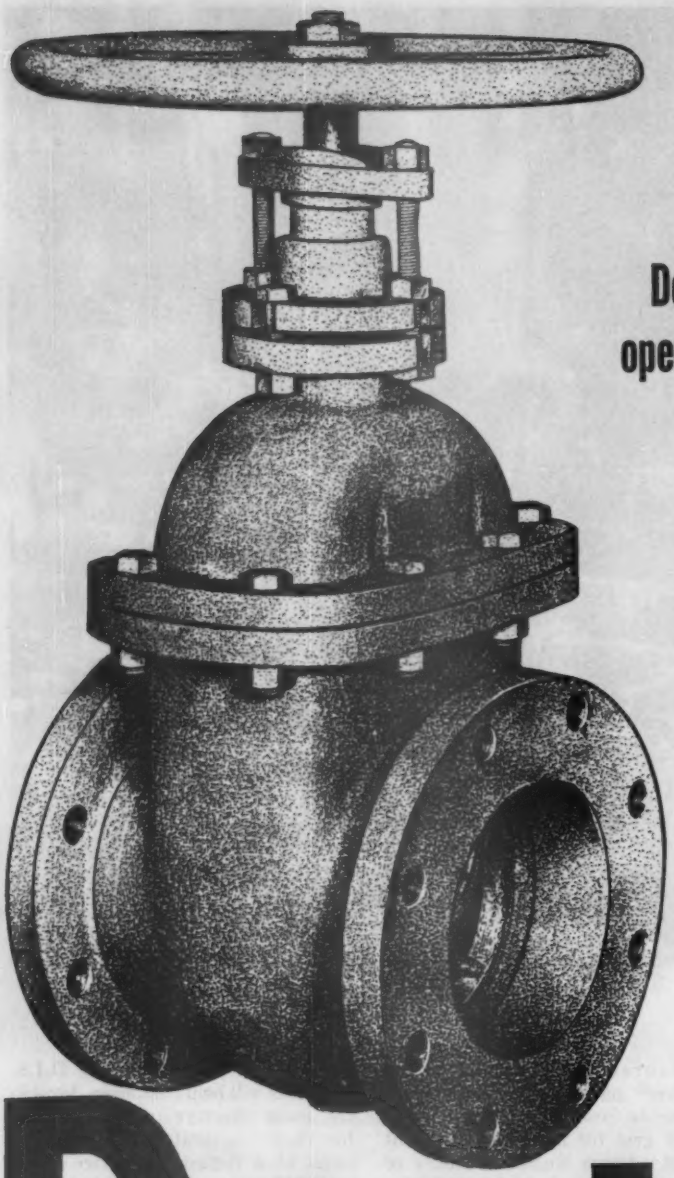
**Pilot plants** employing Dowpac can be rented or purchased, and D.I.S. engineers will help customers develop the most effective use of Dowpac for their particular waste conditions. Dow Industrial Service works with industries of every kind, anywhere in the U. S. Further, D.I.S. offers consulting laboratory service for water and waste treatment, backed by technical resources of THE DOW CHEMICAL COMPANY. For further information, write or call DOW INDUSTRIAL SERVICE, 20575 Center Ridge Road, Cleveland 16, O., Dept. WSW8.

FREE BOOKLET on low-cost, high efficiency waste treatment using Dowpac. Send for a copy today.

DOW

Dowpac is a trademark for packing media—not pilot plants

**DOW INDUSTRIAL SERVICE** • Division of The Dow Chemical Company



# Dependable Darling Gate Valves open fully, close tight—with ease

The fully revolving double disc parallel seat and wedge design minimizes friction, avoids concentration of wear, and automatically compensates for valve seat deflection.

Gate discs are independently hung and free to revolve. They change their seating position at each closing. All working parts are perfectly plain. There are no pockets to collect sediment or prevent free and easy movement.

For assured ease of operation, minimum maintenance, long trouble-free service life, *you can depend on Darling*. Our engineers are always glad to assist you in determining the right valves for your service conditions. Darling Catalog No. 57 gives complete specifications. Write for your copy today.

**DARLING VALVE & MANUFACTURING CO.**
**Williamsport 11, Pa.**

*The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ontario, Canada*
*Vannes Darling-France, 23 rue du Commandant Mouchotte, St. Mandé, France*

**YOU CAN DEPEND ON**

# DARLING

TRADE DARLING MARK

**GATE • BUTTERFLY • CHECK • SPECIAL VALVES • FIRE HYDRANTS**

# THE LEADER FOR OVER 30 YEARS

## *for Accurately Measuring Wide Range of Flows*

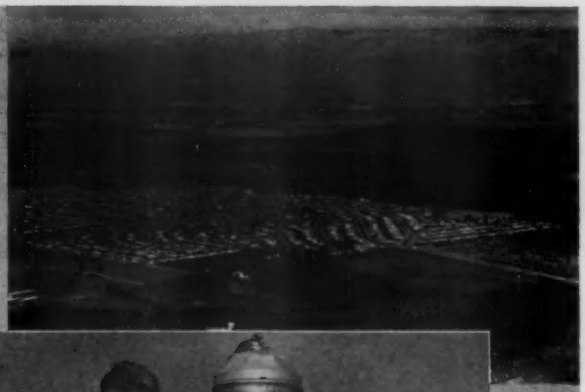
This water meter is a unique combination of a Current Meter, to measure high rates of flow, and a Disc Meter, to measure low rates of flow. They are combined in a single bronze case with a mechanical compound lever type valve, for the purpose of accurately measuring a larger range of flows than can be measured by any single meter. Hersey compounds are ideally suited for apartment buildings, hotels, hospitals and schools. Sizes 2″, 3″, 4″, 6″ in single Bronze Case. 8″ and 10″ in Iron Cases with external bronze by-pass.

Hersey-Sparling
*Meter Company*
HERSEY PRODUCTS
DEDHAM, MASSACHUSETTS

*Branches: Atlanta, Boston, Chicago, Cleveland, Dallas, Denver, Kansas City, Mo., Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle.*

# IOWA Valves and Hydrants

## *by the carload to meet San Jose Water Works' growing requirements*



Glimpse of new subdivision of San Jose, California. City has grown from 95,280 to 202,571 in past ten years.

Unloading scene as IOWA hydrants are delivered by the carload to San Jose Water Works.

Two IOWA gate valves and a new hydrant being installed. Hundreds of these Iowa products are important components of San Jose's modern system.

Carloads of IOWA gate valves and hydrants were purchased by the San Jose Water Works (an investor-owned, private company established in 1866) for installation in their rapidly expanding system which serves seven cities and unincorporated areas in Santa Clara County, California.

Over 17,000 new water service connections were made in the last two years along 1200 miles of water mains to help care for a metropolitan population (Approx. 306,000) which has doubled since 1950.

IOWA products were selected to be a part of the San Jose Water Works' growth because of their proved dependability with minimum maintenance and assurance of long-life performance.

Every year more and more IOWA valves and hydrants are installed to serve the needs of growing communities like San Jose. Experience shows that IOWA products have that extra quality of materials, that extra-precise fitting and assembly that makes for longer life and easier maintenance.

*Let us send you details on the complete IOWA line*

**IOWA VALVE COMPANY**
Oskaloosa, Iowa
Subsidiary of James B. Clow & Sons, Inc.

a CLOW Subsidiary

# when you invest get the best !

PATENTED SILICONE STUFFING BOX PACKING

Split case or frost proof

## lower maintenance

WATCH DOG

## greater accuracy

Offices in principal cities

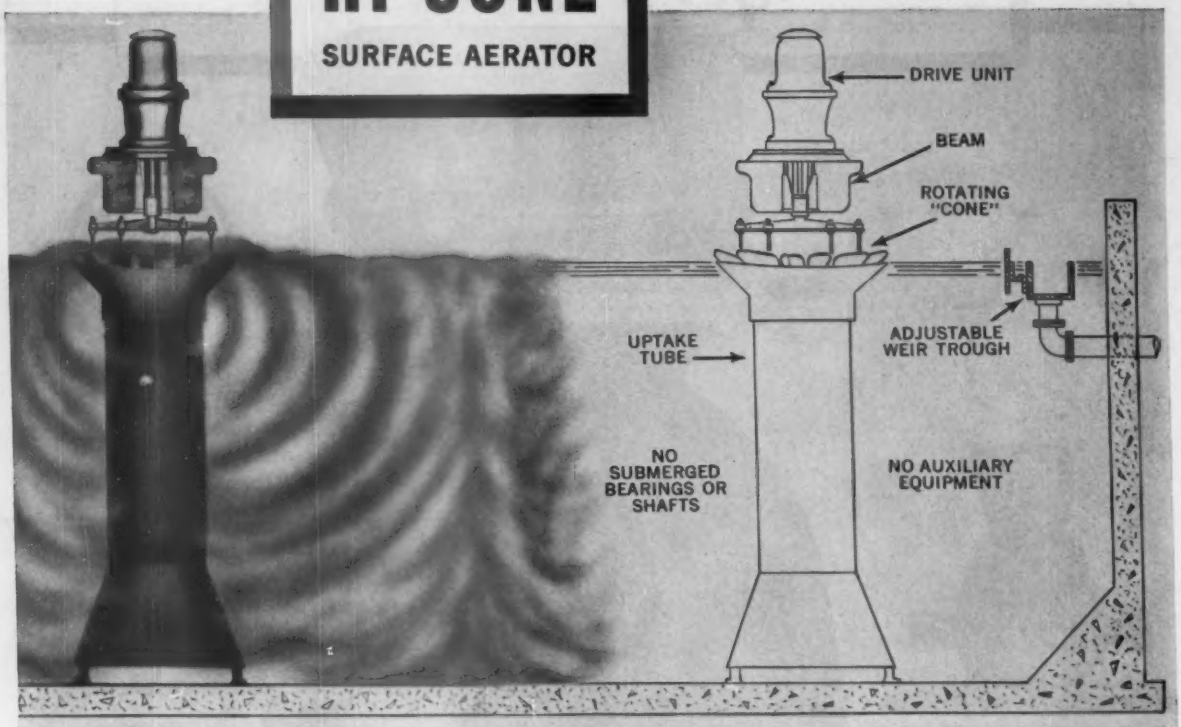
GAMON METER DIVISION

NEWARK NEW JERSEY

WORTHINGTON

# TRUE EFFICIENCY WITH FLEXIBILITY

## HI-CONE®
SURFACE AERATOR




## Units for ALL Sizes of Waste Treatment Plants

**THE TRUE EFFICIENCY** of any type of sewage aerating equipment is best measured in terms of oxygen dissolved into the sewage, not air "delivered" to it. Until the oxygen is in solution, it is not available to the aerobic organisms responsible for purification.

As a result of recent investigations, it is becoming increasingly apparent that oxygen absorption is almost entirely dependent on the rapid and continuous creation of liquid-to-air interfaces. This fact has been long known but not forcibly demonstrated until recently. All oxygen absorption occurs at the liquid "surfaces"—regardless of equipment design or method of aeration.

Therefore, the gauge of efficiency, whatever type of equipment you consider, is "lbs. of oxygen absorbed per KWH."

Compare Hi-Cone's "efficiency rating" with any other aeration equipment. At the same time, investigate the ease with which Hi-Cone handles variations in waste flows and strength through easily adjustable weirs and variable operating speeds. You can get this information by asking your Yeomans representative or the factory for the studies offered at right.

**TYPICAL FLEXIBILITY AND EFFICIENCY OF NO. 70 HI-CONE (OXYGENATION CAPACITY—20° TAP WATER)**

| Inches of Cone Exposure | R.P.M. | Lbs. $O_2$ Absorbed per Hour at 20° C | NET KW | NET KWH per Lb. Oxygen Absorbed |
|---|---|---|---|---|
| ½ | 34 | 37.2 | 7.0 | .188 |
| ½ | 42 | 57.5 | 9.9 | .172 |
| 2 | 38 | 38.7 | 7.3 | .189 |
| 2 | 46 | 54.0 | 10.0 | .185 |
| 4 | 34 | 27.7 | 4.9 | .177 |
| 4 | 50 | 54.0 | 9.5 | .176 |

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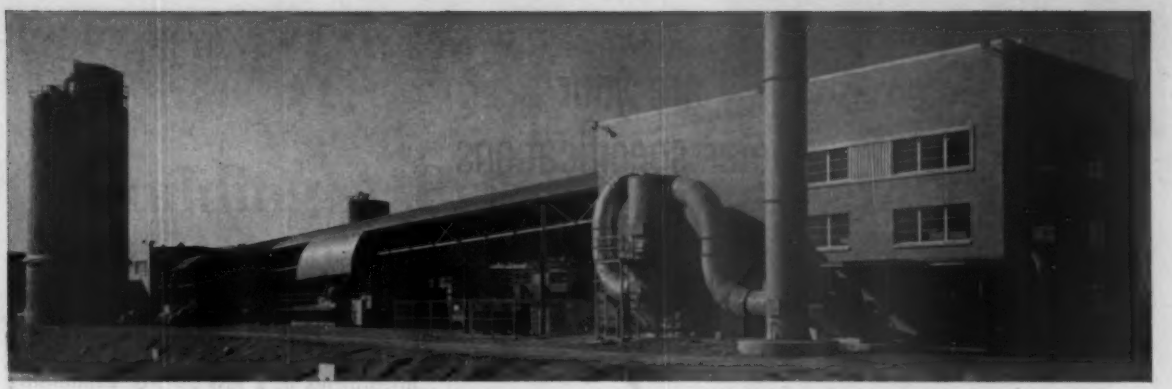

Up to 150 tons of lime a day can be recovered by Dayton's Lime Recalcining Plant. City expects to get its $1,330,000 plant investment back in 20 years — plus a surplus estimated in the millions. *Consulting Engineers: Black & Associates, Gainesville, Florida.*

# at City of Dayton –

## self-amortizing lime recovery plant designed around Magnetic Flow Meters

Dayton, Ohio's million dollar lime recalcining plant would warm the cockles of the thriftiest Scotsman's heart. Designed to recover lime used in softening city water, the plant actually recovers up to 20% more lime than originally added, with additional capacity to process most of the lime sludge accumulated over the last 5 years! City plans to sell the overage — recover its investment in short order.

Dayton's Lime Recalcining Plant was designed around Foxboro Magnetic Flow Meters. Sludge, which would foul-up conventional head-loss devices, is easily measured since these unique meters have no flow restrictions. Measurement is instantaneous—continuous—linear. Rate of flow to centrifuges can be controlled exactly.

Maintenance on the Magnetic Flow Meter is practically nil. There are no pressure taps to get plugged or frozen . . . no seals or purges . . . no moving parts to foul.

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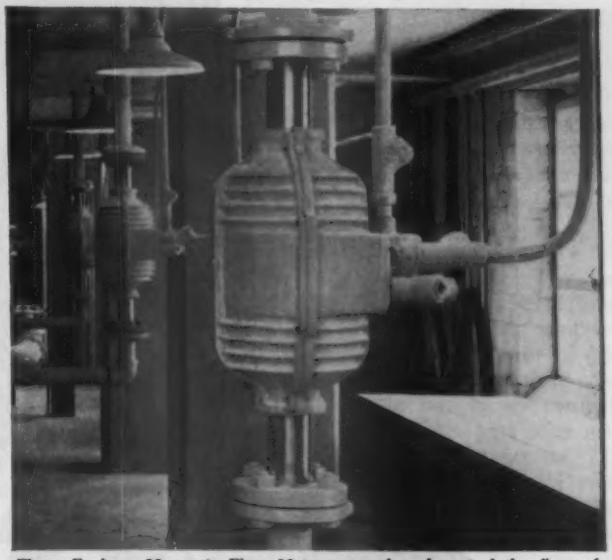
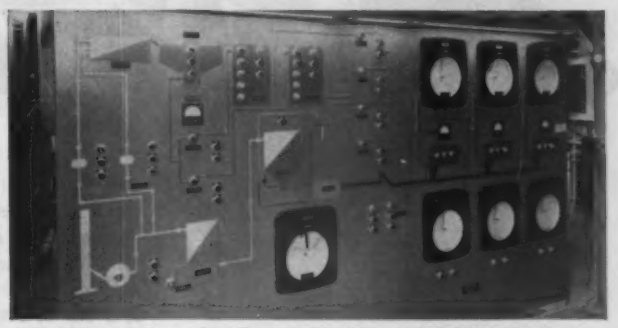


Three Foxboro Magnetic Flow Meters record and control the flow of sludge to centrifuges at Dayton's Lime Recalcining Plant. Meters cannot plug up because they have no flow restrictions.



"Graphic control panel in Feed End Building is helpful in breaking in new operators and in explaining the operation to visitors," reports Plant Supt. Robert C. Stout.

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CONSTRUCTION

# Building A Prison Treatment Plant

by E. E. HALMOS, JR.
Construction Editor

■ BUILDING A TREATMENT PLANT within the grounds of a prison poses some special problems for a contractor — above and beyond those posed by a creek-side site and one of the area's worst winters in many years.

It requires special clearance for contractor personnel, difficulty in obtaining skilled labor and a closer-than-ordinary watch on tools and equipment, since the "residents" of the area are not noted for honesty.

It also imposes limitations on completion time, because the installation not only must serve an expanding "population," but is also part of overall plans for clearing the nearby Potomac River of its excessive burden of pollution.

For these reasons, and including some disputes between the contractor and the District of Columbia's Sanitary Engineering Division over "or equal" equipment and materials, construction hasn't always proceeded smoothly on a new treatment plant for Washington, D. C.'s Correctional Institutions at Lorton, Va., about 20 miles downstream on the Potomac from the city limits.

The prison itself is a little unusual as such institutions go: It is a city prison, but because the District is a federal territory, the prison has all the attributes of a state prison.

LOOKING INTO PRIMARY clarifier, showing installation inside.

Among the inmates are men and women who cover the complete spectrum of crime from juvenile delinquency, panhandling and drunkenness to murder and other capital crimes. Security in some areas is tight.

DETAIL OF FLUME, showing twin channels. Comminutors will be installed at point near man's feet.

The prison installation covers a total of more than 3,500 acres, including shops, dormitories and farm areas, and has a present population of about 3,000. The new plant, just completed, replaces two very much older and now inadequate treatment plants, and is designed to give full treatment to a capacity of three-quarters of a million gallons a day. Its capacity can be increased in the future, to serve a population of 6,500. The new plant also eliminates the need for a new small plant to serve a projected new Youth Correction Center and provides a central treatment facility instead of three isolated plants.

Hilly terrain poses another special problem for construction of about eight miles of sanitary sewer line being built within the prison grounds by prison labor to connect with the new plant, replacing some older lines. Several pumping stations will be built as part of this system. For the moment the plant will be served by existing lines from the various prison buildings, which also include a slaughterhouse, to give treatment before discharging into a tributary of Occoquan Creek, itself a Potomac tributary. The two older plants will be abandoned as soon as possible once the new installation is in full operation.

### Plant Details

The new plant is sited in the 400-ft wide valley of a small creek (Mill Branch) which had to be relocated, in part, to accommodate the installation and which was the cause of part of the construction troubles.

Beginning at the south end of the site, raw sewage enters a double-barrelled Parshall flume, 48 ft long by 7 ft 8 in. at its widest, equipped with two comminutors and a grit chamber. From the reinforced concrete flume, the flow passes through 16 in. OD cast iron pipe with mechanical joints, a distance of 125 ft to the primary clairfier, a concrete structure 55 ft in diameter, 16 ft 5 in. deep, with reinforced concrete walls 15 in. thick.

ANOTHER VIEW of primary clarifier.

## CONSTRUCTION

From the clarifier the next step is a 90 ft diameter trickling filter, 5 ft deep to the top of the channel, with 8 in. thick reinforced concrete walls; thence to a final clarifier of the same dimensions as the primary to a chlorination chamber and an outfall into the creek.

**INSTALLING 16-in. pipe to connect clarifier with trickling filter. Badly decomposed grey shale on sides of hill is typical of ground in area.**

Sludge, meanwhile, is moved to a digester, 45 ft in diameter, 22 ft high, with wall thicknesses varying from 18 inches to 12 inches in thickness. It moves from this digester to 8 drying beds, covering a total area of 165 by 83 ft, separated by 8 in. thick concrete walls. The drying beds have a working depth of 2 ft 6 inches above tile underdrains. They are filled with 12 to 18 in. of washed gravel, then 12 in. of filter sand, thus permitting an 18 in. freeboard. Dried sludge will be used, at least in part, on the prison farms. Fluids will be chlorinated before discharge into the creek outfall.

**GRAVEL UNDERDRAINS are installed around digester and control building, to relieve pressure from sheer bank to the rear. Facing is of prison-made brick.**

Attached to the digester tank is the two-story control building, which will house pumping and electrical equipment, as well as office space and other accommodations for operating personnel. Built of block and prison-made face brick, this structure has cast-in-place concrete floors and rear wall to aid in taking pressure from a steep hillside behind it.

### Construction Work

Clearing the site for these structures and the accompanying pipelines and other utilities presented no special problem for the contractor (Rogers & McGrath, Inc. of Washington, D. C.) in most areas.

The general underlying soil is a badly decomposed grey shale, which can be moved with reasonable ease by tractor-mounted rippers, backshoes and crane shovels. A small amount of blasting was necessary in only one spot, where the control building is set almost flush into the hillside.

**FINAL CLARIFIER. This is the tank that was "floated" by flood.**

Where the trouble turned up was in the area under the sludge drying beds. Here, a centuries-old accumulation of silt, decomposed rock and waste materials had to be mucked out with cranes to depths of up to 15 ft, to reach a firm sand and gravel strata; then the area had to be backfilled with bank run gravel. A total of about 20,000 cu yds of material had to be moved during construction.

Circular walls of the various tanks were formed through use of patented, plywood faced forms (Universal) which could be held without undue strongback and waler bracing. Circular form was achieved by using standard 2 ft wide panels of varying heights, then using standard 2 in. fillers to get proper curvature.

**CHLORINATION CHAMBERS. These tanks served as septic tanks during construction.**

Because the decomposed shale in most of the site provides firm footing for the heavy concrete structures, no unusual foundations were necessary. The biggest problem was in shaping the sloping bottom slabs of the various circular structures to considerable slope, in some cases, toward the center.

These slabs vary in thickness from 4 inches in the trickling filter to 8 in. in the primary clairfier, to 24 inches at the center of the digester. Slope, from outer edge to center, varies from 12 inches in the trickling filter to 5 ft in the digester. Sludge bed walls stand on conventional 1 x 3 concrete footings, resting on the backfill in this area.

Exacting specifications laid down by the city and its consulting engineers dictated hand screening and

**GENERAL VIEW of installation, looking north. Sludge beds in foreground' control building digester at center left.**

smoothing of these floor areas, to meet the required accuracy.

A further problem in pouring the walls and slabs was the city's requirement of its "Class A" concrete —a six-bag mix to reach 3,000 psi in 28 days. This material gets an initial set rather quickly, so pouring operations had to be carried on continuously, once started on any structure. Concrete was delivered in road-mix trucks, by the Virginia Concrete Co., from a plant at Springfield, Va. about eight miles from the site. A total of about 1,400 cu yd of concrete went into the job.

Testimony to the strength of the concrete design came unexpectedly when a small flood and seepage actually "floated" the clarifier, by a few inches, above its original level. It has since been restored to proper level by water flotation and grouting. Not a single crack appeared in the entire structure, despite the unusual stresses and pressure.

### Credits

The plant is being built for the District by the Department of Sanitary Engineering, of which David V. Auld is director, with E. H. Bowen as construction engineer.

Consultants are Massey Engineers, of Alexandria, Va. Superintendent for Rogers and McGrath has been P. L. Grinder.

---

## New Treatise on Timber Piles for Foundation Engineers

A new 62-page book, "Pressure Treated Timber Foundation Piles for Permanent Structures," published by the American Wood Preservers Institute provides a broad range of working information for foundation engineers in the design and construction of their projects.

Highlights of the subject matter are: the use of timber piles, classification and function of end-bearing and friction types, load limit factors, preliminary soil exploration, risks in using untreated piles, complete specifications for selection of timber and of preservatives and treatment. Foundation design and driving data include graphs, tables and formulae as well as information on typical air, steam and diesel hammers.

This useful and well illustrated book may be purchased from the American Wood Preservers Institute, 111 W. Washington St., Chicago 2, Ill., for $1.50 per copy, postpaid.

## A Study of Convective Currents in Water

The Toepler Schlieren method was used in a recent study at the National Bureau of Standards to observe the convective currents that occur in water exposed to normal evaporative cooling.

Vigorous and persistent mixing motions, which took the form of plunging vertical sheets with occasional columnar plunging, were convective currents induced by the normal evaporative cooling of the surface layer of quiescent-appearing water.

Experimental results indicate that such phenomena occur naturally and continuously in any lake, pond, or other body of water exposed to still air, and that they become increasingly vigorous when the air circulates freely over the surface. These results, in line with those derived theoretically by other investigators, will be of aid to engineers and scientists dealing with thermal convection problems in the fields of hydraulic engineering, oceanography, meteorology and astrophysics.

## Water Survey Report of Houston-Gulf-Coast area Available

The first complete report on the water resources in the Houston-Gulf-Coast area bears out belief in the region's ability to serve new industry permanently with abundant supplies of low cost water.

The authoritative study was made by the Houston engineering firm of Lockwood, Andrews & Newman, Inc. who were commissioned by Texas National Bank of Houston. The results have been compiled into a technical report which is now available to industries throughout the U. S.

Unlike many regions of comparable size and industrial activity, the Upper Gulf Coast has always enjoyed a huge surplus of low cost water. This very abundance has discouraged advanced planning on an inter-urban basis for regional water development and allocation plans.

In 1960, however, a plan was adopted to assure that industry's demands for water in the Houston area, including the very promising Lower Trinity Valley, will be satisfied well into the next century.

Completed late in April of this year, the engineer's report includes detailed information on the immediate ground and surface water supplies, potential supply and projected demand through the year 2,000, maps of water storage reservoirs, water supply canals both public and private, ground water distribution.

Requests for the water survey should be typed on company letterhead stationery and directed to Business Development Department, Texas National Bank, Box 2559, Houston 1, Texas.

## World's Largest Clay Pipe With a Factory-Made Compression Joint

A clay pipe, 42 in. in diameter, five ft in length and weighing 2800 lb is being installed in Hoquiam,

Wash. According to Gladding, McBean and Co., it is the largest clay pipe with a factory-made compression joint in the world. Previously, they stated, a 39-in. diameter pipe was the largest ever made.

A discussion on cylinder operators concludes a series of articles on . . .

# Butterfly Valve Actuators—Part III

by A. E. HATCH
B-I-F Industries, Inc.
Providence, Rhode Island

■ THE CYLINDER operator, at this writing, is the most popular actuator for butterfly valves in water filtration plants and in many sewage treatment plants. Reasons behind its wide usage in these fields are: the cylinder is ideally suited for butterfly valve actuation; there is normally a source of hydraulic or pneumatic power available for other services and it is convenient to use this source for valve actuation.

The butterfly valve disc and shaft rotate approximately 90° from the full open to the full closed position. To rotate the disc, a torque must be transmitted through the valve shaft to the disc to overcome resistances opposing this movement. These resistances are seating friction between the valve disc seating edge and the rubber seat; bearing friction resistance between the valve shaft and its bearings; and the forces that tend to close the valve brought about by water flowing over the disc surface. This last phenomenon is referred to as fluid dynamic torque and is due to the air foil effect of the line fluid as it flows past the leading edge of the valve disc. To overcome these forces, it is desirable to use a relatively low fluid power pressure in the actuator. This keeps maintenance at a minimum and provides a smooth and adjustable valve opening and closing speed, helpful in preventing pulsations and water hammer in the pipeline.

The cylinder operator, because of its long stroke and constant piston area throughout the stroke, can be designed to produce required torques at relatively low cylinder pressures (in the 50-100 psi range). Low cylinder pressures mean longer life and less leakage and maintenance at the piston rings or cups. The long stroke also permits use of longer lever arms connecting the cylinder to the valve shaft, thus keeping the stem and bearing loadings down to a minimum, again increasing the life and reducing maintenance. The ports of the cylinder may be equipped with flow control devices for adjusting the speed of opening or closing the butterfly valve.

## Power Sources For Cylinder Actuation

### Water Actuation

Water power has been used successfully for many years as a source of cylinder actuation, especially in water filtration plants where the supply is always available. Its advantages, other than convenience, are primarily that it is an incompressible fluid and provides instant response for positive positioning of the valve disc at a constant rate. The constant rate is most desirable in a rubber seated butterfly valve, as the life of the rubber seat is dependent upon the speed which the valve disc enters or leaves the rubber seating surface. Rapid movement of the disc across the seat tends to distort the rubber and increases wear. While it is not the intent of this article to cover valve controls but simply the actuator itself, it is basically true a cylinder with an incompressible fluid will assume a set position faster and with less overshoot than cylinders actuated by compressible fluids. One other factor in favor of water is there is usually a source of water pressure available independent of electrical power and not subject to failure, such as city water or an elevated tank that can supply water pressure in an emergency for valve operation.

The disadvantages of water are that the discharge from the cylinder on each stroke must be piped to a drain. Also, there may be a corrosion problem if adequate materials are not selected for the internals of the cylinder. Corrosion and scale in the cylinder can cause damage to the piston cups or rings and thereby affect the efficiency of the cylinder. To eliminate this many valve manufacturers and engineers have recommended the use of non-corrosive materials on the cylinder heads and pistons. This is a small initial added expense, but it is well worth the investment to insure long and trouble-free cylinder life. Bronze heads and pistons have become the most popular metal in low pressure water cylinders to eliminate this problem. In all installations a quality strainer should be installed in the supply line to the cylinders.

### Pneumatic Actuation

Air, as a source of cylinder power, has been used quite successfully in recent years. Its main advantage is that it is clean, for there is no exhaust fluid disposal problem. Further, the corrosion problem can be minimized, provided air dryers and filters produce clean, dry air. The main disadvantage of a compressible actuating medium for the rubber seated butterfly valve is its failure to provide a constant disc speed across the rubber seating surface as outlined above. Unless utmost care is taken, the valve disc remains full closed until pressure builds up in the cylinder sufficient to overcome the valve seating torque. The disc then jumps off the valve seat at a speed which can be detrimental to the life of the rubber seat. On non-tight closing butterfly valves, this problem is not a factor and the use of air as a power source is widely used. Air actuated cylinders, in many instances, require the additional expense of providing air dryers and other accessories. It should also be noted that an air compressor is necessary, plus adequate storage compression tanks to provide pressure in the event of power failure.

### Oil Actuation

Oil pressure has not been used to any great extent in the past in water filtration and sewage plants as the advantages have not outweighed the additional expense of providing a complete oil system purely for valve actuation. Occasionally, in large plants where there is a freezing problem eliminating the use of water, and the use of

a compressible fluid such as air is not desirable, the hydraulic oil system is the answer and has been used very successfully. Another advantage of an oil system is that the corrosion problem in the cylinder itself is held to a minimum. The cylinder pressure is dependent, as is the pneumatic system, on air compressors and pump motors and is, therefore, susceptible to power failure.

There are combinations of this power actuation which, while more expensive, are used occasionally, such as air cylinder operators with tandem

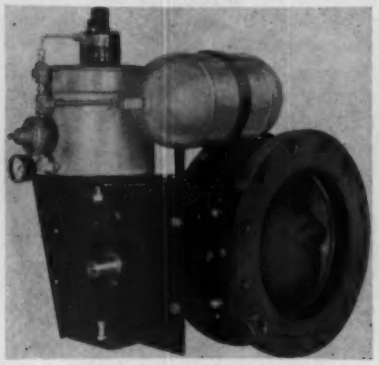

**Fig. 1. RACK and gear arrangement.**

hydraulic cylinders to provide smooth operation and eliminate the jumping action of the valve unseating. In most systems of this type, the hydraulic cylinder has a connection between the cylinder ports with an adjustable orifice in it. This allows the oil to recirculate while the speed of valve opening or closing can be governed by the adjustable orifice.

## Mounting Arrangement of Cylinders on Butterfly Valves

### Rack and Gear

The rack and gear arrangement in Fig. 1 has been promoted by some manufacturers, and it has the advantage of producing a constant torque on the valve shaft throughout the entire stroke of the cylinder. It also has a rigid mounted cylinder with a guided piston rod to eliminate any side thrust on the piston rings or piston rod bearings. This type of linkage is most generally used on open and shut applications and not for throttling as any back-lash or slippage in the gearing would cause a fluctuating control system. In addition to the possibility of "play" in the gearing, this linkage is also susceptible to foreign matter jamming between the gearing and the piston rod rack. Considerable thrust is required to hold the piston rod rack onto the gear, and the forces imposed must be overcome by the cylinder piston.

### Swivel

The swivel type construction as shown in Figure 2 is the most widely adopted and has the advantage of being very compact with practically no side thrust on the piston rings and piston rod bearings. The cylinder lever arm can be arranged on the valve shaft to produce the maximum torque where it is needed most, and a minimum torque with the valve open where bearing friction is practically the only torque to be overcome. This allows for a more economical installation that provides ample operator power to the valve shaft. The only disadvantage to this linkage is the cylinder pivots and flexible hose must be supplied between the cylinder ports and a rigid connection on the valve bracket. Hoses are now available that will provide many years of trouble-free service.

### Toggle Link

The toggle link, as shown in Figure 3, has a rigidly mounted cylinder, and has been used successfully for many years. It is not as compact or as efficient an arrangement as the

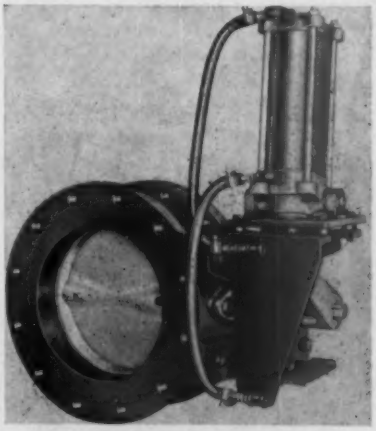

**Fig. 2. SWIVEL TYPE cylinder arrangement.**

other two types, and there is more side thrust on the piston rod.

## Factors Affecting Cylinder Operation and Life

### AWWA Specifications

While it is not the intent here to have detailed discussion of cylinder design, a few items will be discussed that could aid the user in selecting cylinders that will give him the long service he requires. American Water Works Association Specification C-504-55-58 outlines materials of construction for pneumatic or hydraulic cylinders. The specifications are based on long field experience and cylinders purchased to these specifications will give excellent service.

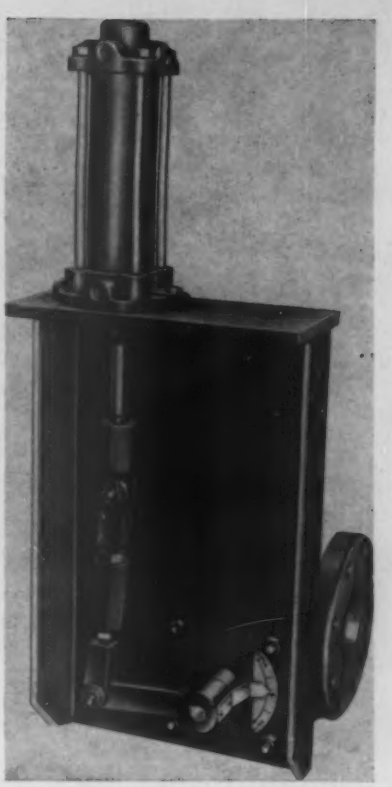

**Fig. 3. TOGGLE LINK cylinder arrangement.**

### Cylinder Pressure

There are a few basic features affecting cylinder life and maintenance that we will cover here, these being pressure, cylinder roundness and wall finish, piston cups or rings, piston rod finishes, and dirt or scale. Regarding pressure, it is fairly safe to say maintenance goes up with the cylinder pressure. As the pressure goes up, there is more elongation of the tie rods or working of the seals between the cylinder head and piston barrel, and simply more all-around strain on cylinder working parts. As a rule of thumb, we would recommend that cylinder pressure be kept under 150 psi, with pressures in the vicinity of 50-100 psi being about the ideal for

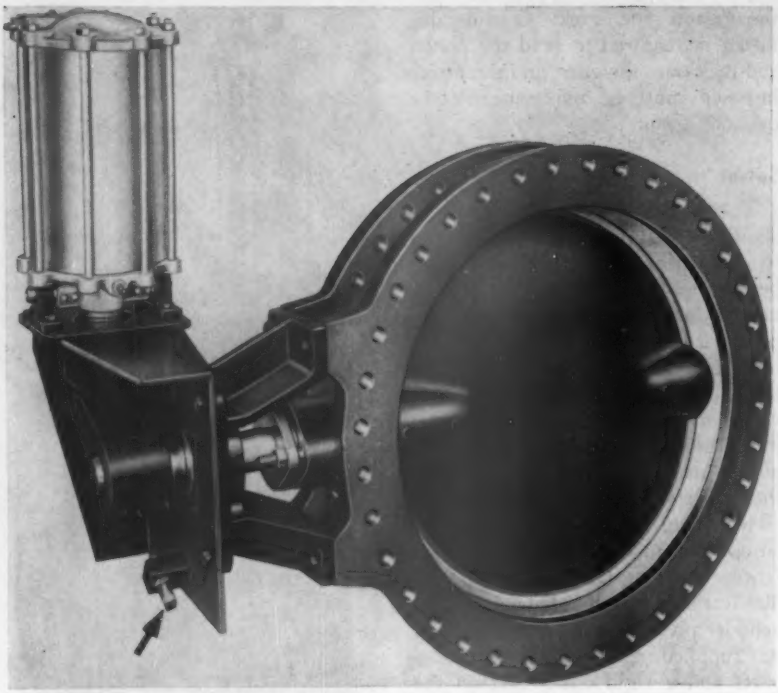

Fig. 4. ADJUSTABLE stops.

water cylinder operated, rubber seated butterfly valves.

### Roundness

Roundness is the heart of all cylinder operation; the cylinder barrel, piston, and piston rings, or cups must all fit together with fairly close tolerances and be absolutely symmetrical around the piston rod. To assure this until a few years ago, water works engineers and users called for cylinder barrels of cast iron lined with bronze tubing. As it is not desirable to hang a heavy cast iron cylinder on the butterfly valve, manufacturers in later years have switched to stronger, more rigid cylinder barrels of centrifugally cast bronze with excellent results. The wall finish on the inside of the cylinders is also very important. AWWA specifications call for the inside diameter to be honed to at least a 15 RMS (Root Mean Square) finish.

### Piston Seals

Three basic types of piston seals have been used, the first being cups of leather construction. While these have been used for many years. their disadvantages are that they have a high friction coefficient against the wall of the cylinders, and they absorb water, causing swelling. O-rings have been used in many instances and, while their friction is low, they do have a tendency to twist or spiral in the piston slots. In recent years, "U" or "V" packings have been used with much success. This type of packing can be supplied with a square back to eliminate the tendency to twist. Friction is low with this type ring.

### Packing

All types of packing can now be made of synthetic rubbers that keep moisture absorption and swelling to a minimum. It is particularly important that the piston rod have a hard finish and be of a non-corrodible material. AWWA specifications call for stainless steel piston rods having a 5 to 10 RMS finish with a surface of hard chrome plate, a minimum of .0005" thick. This prevents leakage on the piston rod itself. The cylinder should also be equipped with a dirt wiper to clean the piston rod before it enters the cylinder.

The most common cause of cylinder trouble is the presence of dirt or scale in the water, damaging the piston rings or cups. This point has been covered before, and it is sufficient that strainers be used and non-corrosive material be used throughout the cylinder where in contact with water. However, the trouble that can arise from scale in a cylinder cannot be stressed too strongly.

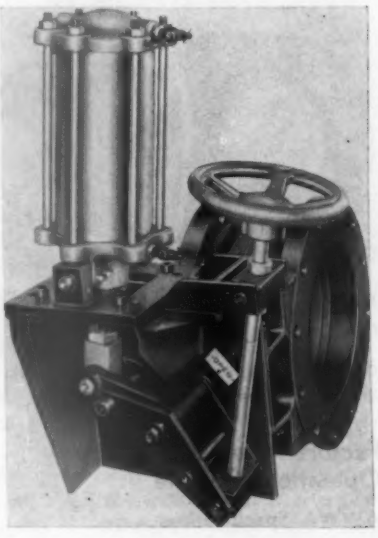

Fig. 5. AUXILIARY manual.

## Standard Methods of Actuation

A double-acting cylinder must have pressure applied to one side of the piston and removed from the other to stroke a butterfly valve. To do this, it required either one 4-way valve, two 3-way valves, or four 2-way valves in the control system to the cylinder. In most instances, a single 4-way valve is used. These valves may be hand actuated by lever, remotely actuated by solenoids, or driven by diaphragms, either pneumatic or hydraulic. Four-way valves are available with neutral positions so that a valve may be stopped in an intermediate position for throttling or control purposes. For prolonged throttling, a positioner should be used. A positioner is an instrument that positions a valve to correspond to a signal received from a manual loading station or other device such as a level or flow controller. Should the valve tend to drift from the position called for by the controller, the positioner takes corrective action and maintains the proper position.

## Accessories Available

### Adjustable Stops

All cylinders or their mounting parts should be provided with adjustable stops to terminate the rotation of the valve disc. These stops may be mounted where they are accesible as shown in Figure 4. A less expensive arrangement is to use the cylinder heads themselves as the

stops, making adjustments in the link between the cylinder piston rod and the valve lever arm.

### Operating Speed

Where it is required to adjust the speed of the closure or opening, speed control valves are available for this purpose. Where accurate metering of the flow from the cylinder is required, flow control valves that furnish free flow in one direction and calibrated throttle flow in the opposite are available. Where it is not too critical an adjustment, simple needle valves may be utilized.

### Auxiliary Manual Operation

Auxiliary Manual Operation is available with most cylinder operators as shown on Figure 5.

### Valve Position Indicators

For position indication, all cylinders are equipped with local indication and transmitters are available for remote position indication, either pneumatically or electrically.

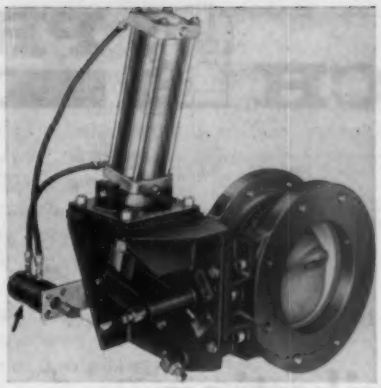

Fig. 6. 4-WAY VALVE positioner.

### Valve Positioners

When cylinders are used on a control system, 4-way positioners are available, either all pneumatic or of the hydro-pneumatic type, as shown in Figure 6.

### Fail Safe Protection

In some instances, it is desirable to have a valve closed immediately upon loss of power supply. This can be accomplished by the use of volume chambers to store enough air under pressure to close the valve once; or, it also may be accomplished by springs built into the cylinder. The springs are usually used where very fast speed of closure is required in the event of power failure.

## Conclusion

We have briefly covered a few details on cylinder operators for butterfly valves and some of the reasons why they have gained such wide acceptance. Actually, any one of the sections above could be an article in itself. However, we hope this brief discussion will be helpful to the reader.

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## Report from the Columbia River Basin Project

The development of comprehensive water resource plans by river basins, coordinated among all concerned agencies and levels of government, and providing maximum benefits for all purposes—hydroelectric power, irrigation and reclamation, navigation, recreation, health, home and industry—are basic national goals stated by the President in his Natural Resources Message of February 23, 1961.

"The full development of the power and other water resource potentials of the Columbia Basin is a vision that must be fulfilled," is a specific goal addressed to the Pacific Northwest.

The Columbia River Basin Project was designed to supplement State and local planning operations in both water supply and water quality management activities.

The findings of the project will directly aid the programs of agencies responsible for conserving and developing the water resources of the Pacific Northwest to meet the region's growing needs. The project's four major sections, and ways in which the findings can be utilized, are as follows:

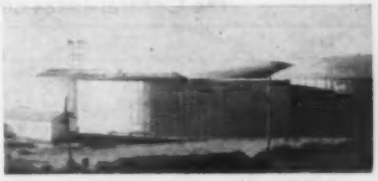
1. The determination of the water requirements for municipalities and industries in the Columbia Basin region and the development of engineering recommendations to meet these quantity requirements.
2. The development of a water management plan to protect and control the quality of the region's water resources.
3. The development of a report on the adequacy of water resources to meet the needs of the major water using groups, making available information on the volume and the physical, chemical and biological quality of the region's water.
4. The identification of research needs, with particular emphasis on the problems unique to the Pacific Northwest region, and the recommendation of measures for implementing such research at appropriate public and private facilities.

The report defines the physical characteristics, economic characteristics, population, water supply and quality problems and programs and so on of the huge Pacific Northwest. It also gives a complete description of the organization of the study made by the Project.

Conclusions are reached that, although distribution of water is not good, supply is adequate for the increasing population of these states. Further studies will result in more detailed reports on the problems of that great expanse of our Nation, the Pacific Northwest.

## Spain's First Prestressed Concrete Water Tanks by American Firm

Spain's first prestressed-concrete water tanks have been designed and prestressed by the Preload Co., Inc., New York, in cooperation with its affiliate, Preload Iberica in Madrid.



The newly completed tanks were constructed for the mining town of Oviedo in the north of Spain, near the Bay of Biscay. Oviedo has always had a "dry season" problem, with most of its rainfall concentrated in three months of the year.

To solve the problem, the town decided to store water during the rainy period for the dry season. Accordingly, Oviedo contracted to build five identical three-and-a-third-million-gallon prestressed-concrete tanks, believed to be the largest of their kind in Europe.

RESEARCH PROGRESS REPORT

Salinity, pH, and turbidity were considered in studies of . . .

# Coliform Distribution in Central Texas Bays

by CARL H. OPPENHEIMER[1]
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■ IN 1958 the Texas State Department of Health contacted the Institute of Marine Science, University of Texas, to survey coliform distribution in the Central Texas bay systems during 1958-1959. One objective was to determine whether sewage effluent being released into the bays from river drainage and from towns on the baysides produced a potential health hazard. The detritus feeding oysters concentrate coliforms along with normal food materials.

Oysters which are taken for commercial purposes in Texas must be obtained from bays approved by the Texas State Department of Health as being free of contamination. Such approvel is based on the findings of sanitary and bacteriological surveys made in the ovster producing waters. If oysters are to be shipped out-of-state, or into Texas towns which have local ordinances prohibiting the sale of non-certified oysters, the containers must bear the certification number issued to the dealer by the Texas State Department of Health. The procurement of such a certificate is based upon the dealers' compliance with the rules and regulations set forth by the United States Public Health Service governing the growing area as well as the processing plants.

**Table 1**

**Gallons of certified oysters harvested during the 1959-1960 oyster season in San Antonio, Espiritu Santo, Mesquite, Aransas, and Copano Bays on the Central Texas coast***

| Bay | Gallons of Oysters[1] |
|---|---|
| San Antonio | 53,073 |
| Espiritu Santo | 19,799 |
| Mesquite | 414 |
| Aransas[2] | 1,166 |
| Copano | 1,855 |
| Total | 76,307 |

[1]Reported by only certified dealers.

[2]Aransas Bay closed to harvesting on December 20, 1959, by the Texas Game and Fish Commission.

*Values were secured from the Texas State Department of Health and do not include the harvest of uncertified oysters. The reported numbers of certified oysters are estimated to be 90 per cent of the total number of oysters removed from the bays. Total wholesale value approximates $425,000 per year.

In conducting bacteriological surveys of oyster growing areas, coliform organisms are used as indicators of fecal pollution. Coliform organisms may also be used as hydrographical tracers of the distribution of fresh water in marine bays because of their short life expectancy in the marine environment. The large number of drainage systems along the shores of Espiritu Santo, San Antonio, Mesquite, Aransas, and Copano Bays (Figures 1 and 2) provided an opportunity to investigate the possibility that effluents from sewage treatment plants in the water shed may render oysters from certain reefs in the central Texas bays unfit for human consumption. As a result, data on coliform organism distribution, salinity, pH, and turbidity were collected from November, 1958, through October, 1959, from stations shown in Figure 2. This information provided a prognosis of the potential health hazard of the bays and revealed hydrographic conditions influencing coliform organism distribution in a marine environment.

During the 1959-1960 oyster harvest, 76,307 gallons of certified oysters, representing a wholesale value of nearly $382,000, were taken from the oyster beds within the five bays studied in the survey. The quantity obtained from each bay is given in Table 1.

Espiritu Santo, San Antonio, Mesquite, Aransas, and Copano Bays are shallow, marine bays situated entirely behind a barrier island extending the length of the Texas coast. The only openings through which water may pass into the bays are at Port Aransas and Pass Cavallo. A complete description of the hydrographic features of the area has been given by Collier and Hedgpeth (1950). Salinity of the water in these bays varied from 34 parts per thousand (0/00) near the mouth of the passes to fresh water (.8 0/00) near the rivers. Oysters will grow

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within a salinity range of 15 to 30 0/00. Annual temperature ranged from 2° to nearly 40° C. High primary production (Odum and Hoskins, 1958) of 5 to 10 gm/$M_2$/day (annual average) was characteristic. High organic matter production was associated with a large accompanying population of other marine microorganisms. Bacterial population up to 10,000,000 per ml of bay water by direct membrane filter counts have been reported (Jannisch and Oppenheimer, personal communication).

Bay water was turbid throughout the survey as a result of the constant wind stirring the clays, detritus, and microorganisms from the sediments. Water level changes, usually attributed to changes in tide, were nearly always caused by northers (wind velocity up to 60 mph) in the winter months and southeasterly winds (10 to 30 mph) during the summer. In general, wind tides ranged less than two feet.

The principal fresh water drainage into the bays was from the Guadalupe and San Antonio River basins, which together have an overall airline length of 240 miles and a maximum airline width of 90 miles (Figure 1). The total water shed area approaches 12,320 square miles: Guadalupe drainage containing approximately 6,030 square miles of water shed; San Antonio River approximately 4,190 square miles; and the Mission and Aransas Rivers have a combined shed totaling approximately 2,100 square miles. River flow values during 1958-59 are presented in Figure 3.

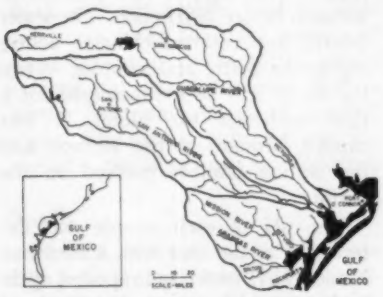


**Fig. 1. WATERSHEDS AFFECTING Copano, Aransas, Mesquite, Espiritu Santo, and San Antonio Bays.**

On the immediate water front along the bays are the towns of Seadrift, Rockport and Aransas Pass, Texas. Table 2 lists estimated population of towns near the bays and the average daily discharge of sewage from each town.

Coliform organisms inhabiting the five bays may have originated from surface drainage from the water shed (Figure 1), small town sewage treatment plant effluent (Table 2), and from indigenous populations of organisms in porpoises, wild fowl, and fishes.

**Table 2**

**Estimated populations and average daily sewage treatment plant effluent from towns located near San Antonio, Aransas, and Copano Bays.**

| City | Population | San Antonio Bay Average Daily Flow in Gallons |
|---|---|---|
| Victoria | 39,800 | 3,000,000 |
| Seadrift | 12,000 | 45,000 |
| Tivoli | 550 | 11,000 |
| Total | 52,350 | 3,056,000 |
| | | **Aransas and Copano Bays** |
| Refugio | 4,700 | 200,000 |
| Woodsboro | 2,000 | 80,000 |
| Rockport | 3,700 | 159,000 |
| Sinton | 7,500 | 320,000 |
| Taft | 5,000 | 235,000 |
| Aransas Pass | 8,000 | 420,000 |
| Total | 30,900 | 1,414,000 |

Greenberg (1956), in a review of the survival of enteric organisms in sea water, has emphasized that health hazards in estuaries, bays, and on beaches can be caused by enteric organisms. He postulates that coliform organisms disappear at a more rapid rate than is accounted for by dilution alone, with a net result of partial or complete disinfection or self-purification of sea water. Many cases of typhoid fever and gastrointestinal disturbances have resulted from the eating of raw oysters collected from sewage polluted waters (Wise, Winston, and Culli, 1943). Wise, *et al* (1948) cite an outbreak of food poisoning occurring in 1944 as the "apparent result" of eating raw oysters at a fraternity banquet. The oysters were harvested from Galveston Bay, Texas, and the incident led to an investigation of the sanitary conditions of the oyster beds of the bay. Orlob (1956) lists the effects of nutrients, temperature, and sedimentation on the length of survival of sewage-associated bacteria in sea water. The survival time was found to be approximately one month or less for residual *E. typhosa*, and coliform organisms usually have a 90 per cent mortality within one to three days. Rittenburg, Mittwer, and Ivler (1958) found coliform organisms in sediments extending considerable distances around outfalls discharging unchlorinated primary treated effluent. No precise estimate was derived of the survival time of coliform organisms in the sediment. Carlucci and Pramer (1960) indicate that sea water is toxic to *E. coli*.

The only known previous study of coliform organisms in the Central Texas bay system is an unpublished report by A. Haneman, Jr. dated March, 1938. Sampling stations used for the 1938 study are similar to those chosen for obtaining data presented here. Results of the bacteriological examination of *B. coli* (later termed *E. coli*) were expressed in an arbitrary numerical system (Parsons, 1952) known by the American Public Health Association as "Method of Scoring Oysters" (Table 3).

**Fig. 2. STATIONS SAMPLED in the five days during 1958 and 1959.**

Tests were performed by placing five 1 ml portions of 1:1, 1:10, and 1:100 dilutions in lactose fermentation tubes and incubating the tubes for two days at 37° C. Tubes containing gas at the termination of the period were transferred to Endo or litmus lactose agar plates. Char-

Table 3

**Preliminary Sanitation Survey (1937-38)* report of coliform presence in Espiritu Santo, San Antonio, Mesquite, Aransas, and Copano Bays, Texas, employing Parson's scoring method (Parsons, 1952).**

| Bay Sampled | Station Number | Score for Presence of Coliforms (Month) May, 1937 | Aug., 1937 | Dec., 1937 | Jan., 1938 |
|---|---|---|---|---|---|
| Aransas | 1 | | | 0.1 | 0 |
| | 2 | 0 | | | 0 |
| | 3 | | | 10.0 | 0 |
| | 4 | 0 | | 0 | 0 |
| | 5 | 0 | | 0 | 0 |
| | 6 | 0 | | | 0 |
| | 7 | 0 | | | 0 |
| | 8 | 0 | | | 0 |
| | 9 | | | | 0 |
| | 10 | | | 0.2 | 0 |
| | 11 | | | 0 | 1.0 |
| Copano | 1 | | | 0 | 1.0 |
| | 2 | 0 | | 0.1 | 1.0 |
| | 3 | | | 2.0 | 11.0 |
| | 4 | 0 | | 0 | 0 |
| | 5 | 0 | | | 11.0 |
| | 6 | 0 | | | 20.0 |
| | 7 | 0 | | | |
| | 9 | 0 | | | 20.0 |
| | 10 | 0 | | | |
| | 11 | 0 | | | 0 |
| | 12 | | | 0.2 | 110.0 |
| Mesquite | 1 | 0 | 0 | | |
| | | 0 | 0 | | |
| San Antonio | 1 | | | | 0 |
| | 2 | | | | 10.0 |
| | 3 | | | | 0.1 |
| | 4 | | | | 0 |
| | 5 | | | | 0 |
| | 6 | | | | 0 |
| | 7 | | | | 0 |
| Espiritu Santo | 1 | 0 | 0 | | 0 |
| | 2 | 0 | 0 | | 0 |
| | 3 | 0 | 0 | | 0 |
| | 4 | | 0 | | 0 |
| | 5 | | | | 0 |
| | 6 | | 0 | | 0 |

*Unpublished; Haneman (1938).

acteristic types of *B. coli* were transferred to a second lactose broth fermentation tube and plated on agar. The tubes were examined microscopically to determine if the organisms had produced spores. If the presence of *B. coli* was confirmed, values representing reciprocals of the greatest dilutions were assigned each tube. Calibrations were made using the following values: 1 for *B. coli* positive in 1.0 cc but not in 0.1 cc; 10 if present in 0.1 cc but not in 0.01; and 100 for *B. coli* positive in 0.01 cc. The highest values of five fermentation tubes were added together and the total value of the sample scored. It is impossible to convert accurately the scores to MPN (most probable number) but an approximate comparison could be:

| *Score* | *MPN/100 ml* |
|---|---|
| 0.1 | 2.0 |
| 0.2 | 4.0 or 4.5 |
| 1.0 | 20 |
| 2.0 | 40 or 45 |
| 10.0 | 45 |
| 11.0 | 68 |
| 20.0 | 400 or 450 |
| 110.0 | 6,800 |

## Procedures

The stations chosen for sampling procedures (Figure 2) were sites of commercial reefs being exploited by commercial fishermen, and were selected after considering known records of oyster harvests, reports from the State Department of Health and information provided by the Texas Game and Fish Commission Laboratory at Rockport, Texas. The depth of water in the oyster producing areas of the bays ranged from 0.3 to 3.0 meters; the deepest portion in Aransas Bay extending to approximately 4 meters (Table 4).

The reefs were covered by water a few centimeters to two meters deep. It was noted that most reefs were perpendicular to the average wind direction. Wind continually washed water over the reefs carrying food to the oysters. Salinity and nutritional content were satisfactory for oyster culture and growth as evidenced by the productive commercial reefs in the bays. The areas were open to the public and not privately leased.

The Corpus Christi-Nueces County Health Department supplied 100 ml sterile sample bottles and prepared them with a protective cover of wrapping paper over the neck and cap. A long-handled sampling device was used which allowed the collector, (from a boat), to open and close the bottle in water at a depth of 50 cm. above the bottom. The bottle and holder were dipped into a chlorine solution before immersion. The water diluted any residual chlorine adhering to the bottle and samples. When the bottle had been submerged for a time sufficient for filling, it was capped, brought to the surface, and the station number marked on the bottle.

The pH of each sample was determined in the boat with a Beckman Model G pH meter and repeated again later in the laboratory. Chlorinity of each sample was determined by the standard silver nitrate test. A unit consisting of a salinometer, photometer, and thermistor recorded salinity profiles, temperature, and light penetration *in situ*. No attempts were made to convert chlorinity values to salinity.

Samples were placed on a rack in a portable ice chest and within twenty-four hours from the time of collection were transported to the Corpus Christi-Nueces County Health Department Laboratory for analysis. Temperature in the ice chest was below 6° C from the time the samples were placed inside until laboratory

examinations were made.

Upon reciept at the laboratory, samples were shaken thoroughly and inoculated into fermentation tubes containing lauryl tryptose broth. Dilutions were made with sterile, phosphate-buffered, dilution water. Five tubes, each containing double strength broth, were inoculated with a ten ml portion of the sample. Another five tubes, each containing a single strength broth, were inoculated with a 1.0 and 0.1 ml portion of the sample. The fermentation tubes were agitated gently and incubated at 35 ± 0.5° for 24 ± 2 hours. At the end of 24 hours, the gas positive tubes were removed and brilliant green bile broth was used to confirm the presence of coliform organisms. Gas negative tubes were allowed to incubate for an additional 24 ± 3 hours. Tubes containing gas after 48 hours were submitted to the same confirmation test. A loop full of material from positive lauryl tryptose tubes was inoculated into brilliant green bile broth and EMB during two runs to compare the two confirmatory media.

Sediment samples were collected in a one-inch glass tube which was manually inserted into the sediment. After being removed from the bottom of the bay, the sediment was pushed through the tube until the surface portion was flush with the mouth. One ml samples were taken from the surface of the sediment in a tube with a sterile syringe and placed in sterile dilution bottles containing 99 ml of distilled water. The diluted sediment was analyzed in the laboratory for coliforms.

## Results

Annual coliform counts from station S-13 are correlated with Guadalupe River gauge readings during 1958-59, as shown in Figure 3. Figures 4 and 5 illustrate distribution of chlorinity and coliforms in San Antonio Bay during November, 1958, and July, 1959. Evaluation of November chlorinity data shows that fresh water from the Guadalupe River flowed along the southwest side of the bay; in July the flow was along the northeast side. Data on monthly coliform organism counts are compiled in Table 5.

Distribution of coliform organisms in San Antonio Bay corresponded to the low chlorinity throughout the year, establishing the river as their origin. Non-toxic, red tide, plankton

Table 4

**Water depth and minimum, maximum, and average values for temperature and chlorinity from November, 1958 to October, 1959**

| STATION | WATER DEPTH c m | TEMPERATURE | | | CHLORINITY (0/00) | | |
|---|---|---|---|---|---|---|---|
| | | Minimum | Maximum | Average | Minimum | Maximum | Average |
| Aransas Bay | | | | | | | |
| 1 | 25.4 | 7.0 | 28.9 | 18.7 | 7.9 | 18.0 | 12.4 |
| 2 | 7.6 | 7.0 | 28.8 | 18.6 | 7.8 | 14.0 | 10.4 |
| 3 | 22.8 | 6.0 | 28.4 | 18.4 | 7.9 | 14.4 | 10.5 |
| 4 | 20.3 | 7.0 | 28.5 | 18.8 | 7.9 | 14.8 | 10.4 |
| 5 | 20.3 | 10.0 | 29.0 | 20.2 | 7.7 | 13.6 | 9.8 |
| 6 | 20.3 | 10.0 | 29.0 | 20.1 | 7.1 | 14.0 | 9.8 |
| 7 | 20.3 | 6.0 | 28.0 | 18.5 | 7.9 | 14.0 | 10.6 |
| 8 | 12.7 | 7.0 | 29.0 | 19.1 | 4.2 | 22.0 | 11.1 |
| 9 | 10.1 | 7.0 | 28.0 | 18.6 | 8.0 | 12.8 | 10.3 |
| 10 | 12.7 | 10.0 | 29.0 | 19.9 | 7.2 | 13.6 | 9.1 |
| 11 | 25.4 | 7.0 | 28.0 | 18.7 | 7.9 | 16.8 | 11.6 |
| 12 | 5.0 | 7.0 | 28.0 | 19.0 | 7.2 | 12.0 | 9.4 |
| Copano Bay | | | | | | | |
| 1 | 17.7 | 10.0 | 29.0 | 20.0 | 7.2 | 12.8 | 8.9 |
| 2 | 17.7 | 10.0 | 29.0 | 20.0 | 6.8 | 13.2 | 9.0 |
| 3 | 7.6 | 10.0 | 29.0 | 20.0 | 6.8 | 12.4 | 8.9 |
| 4 | 10.1 | 10.0 | 29.5 | 20.3 | 6.8 | 11.6 | 8.7 |
| 5 | 12.7 | 10.0 | 29.0 | 20.1 | 6.4 | 9.2 | 7.5 |
| 6 | 10.1 | 10.0 | 29.5 | 20.3 | 6.4 | 9.2 | 7.5 |
| 7 | 12.7 | 10.0 | 29.5 | 20.3 | 6.4 | 9.2 | 7.5 |
| 8 | 12.7 | 10.0 | 29.5 | 20.3 | 6.0 | 12.0 | 7.7 |
| 9 | 15.2 | 8.0 | 29.5 | 20.0 | 6.0 | 14.0 | 8.1 |
| 10 | 12.7 | 10.0 | 29.5 | 20.1 | 6.8 | 14.0 | 8.6 |
| 11 | 20.3 | 10.0 | 29.0 | 20.0 | 6.1 | 10.8 | 8.2 |
| 12 | 12.7 | 10.0 | 29.5 | 20.2 | 6.0 | 8.8 | 7.3 |
| 13 | 10.1 | 10.0 | 29.5 | 20.5 | 6.0 | 8.8 | 7.1 |
| Mesquite Bay | | | | | | | |
| 1 | 2.5 | 8.0 | 29.8 | 19.5 | 6.0 | 12.4 | 9.5 |
| 2 | 7.6 | 8.0 | 29.0 | 19.6 | 8.0 | 16.4 | 10.3 |
| 3 | 7.6 | 8.0 | 29.0 | 19.4 | 6.8 | 14.0 | 10.1 |
| San Antonio Bay | | | | | | | |
| 1 | 17.7 | 12.0 | 30.0 | 21.5 | 2.0 | 11.6 | 5.7 |
| 2 | 15.2 | 10.2 | 30.0 | 21.0 | 2.8 | 8.7 | 5.7 |
| 3 | 7.6 | 10.0 | 30.0 | 21.0 | 6.0 | 10.4 | 7.1 |
| 4 | 10.1 | 8.0 | 30.0 | 20.2 | 4.4 | 12.4 | 8.9 |
| 5 | 12.7 | 8.0 | 29.2 | 20.1 | 4.8 | 16.0 | 10.6 |
| 6 | 15.2 | 8.0 | 30.0 | 20.2 | 7.4 | 21.2 | 11.7 |
| 7 | 2.5 | 7.0 | 28.8 | 19.6 | 5.6 | 11.2 | 8.8 |
| 8 | 2.5 | 7.0 | 29.8 | 20.1 | 5.6 | 19.2 | 8.8 |
| 9 | 12.7 | 9.0 | 29.2 | 20.0 | 2.8 | 10.4 | 7.8 |
| 10 | 12.7 | 11.0 | 30.0 | 23.0 | 2.0 | 8.6 | 5.3 |
| 11 | 7.6 | 12.0 | 30.0 | 21.1 | 1.6 | 8.5 | 4.1 |
| 12 | 7.6 | 12.0 | 30.0 | 21.1 | 0.8 | 8.5 | 2.1 |
| 13 | 7.6 | 12.0 | 30.0 | 21.5 | 0.4 | 8.6 | 1.3 |
| 14 | 15.2 | 10.0 | 30.0 | 21.2 | 4.0 | 9.6 | 6.1 |
| 15 | 15.2 | 10.0 | 30.0 | 21.1 | 4.4 | 10.2 | 6.5 |
| 16 | 17.7 | 8.0 | 29.2 | 19.7 | 7.6 | 10.0 | 8.6 |
| Espiritu Santo Bay | | | | | | | |
| 1 | 25.4 | 8.0 | 29.9 | 20.0 | 8.0 | 18.8 | 14.2 |
| 2 | 2.5 | 10.0 | 29.9 | 20.6 | 8.0 | 16.8 | 15.2 |
| 3 | 20.3 | 9.0 | 30.0 | 20.1 | 8.0 | 16.4 | 14.4 |
| 4 | 20.3 | 9.0 | 30.0 | 20.1 | 8.0 | 18.0 | 14.8 |
| 5 | 20.3 | 9.0 | 30.0 | 20.1 | 7.9 | 16.4 | 14.7 |
| 6 | 20.3 | 9.0 | 29.0 | 20.1 | 7.8 | 16.8 | 12.8 |

blooms were noted during the spring near Station S-9. Chlorinity values at this time depict mixing of river and bay water providing favorable conditions for the bloom of certain plankton. Coliform organism distribution in the fine sand and clay sediments of San Antonio Bay during October is shown in Table 6.

Table 5

**Coliform count (MPN) per 100 ml in monthly samples taken from five bays on the Central Texas coast.**

| BAY SAMPLED | STATION | DATE AND COLIFORM COUNTS 1958 Nov. 11-23 | Dec. 12-16 | Jan. 1-11 | Jan. 1-26 | Feb. 2-16 | Mar. 3-30 | Apr. 4-28 | June 6-2 | 1959 July 7-26 | Oct. 10-8 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Espiritu Santo | 1 | NS* | | | | 11 | | 2 | | | |
| | 2 | 2 | | | | 4.5 | | | | | 9.3 |
| | 3 | | | | | | | | | | |
| | 4 | | | | | | | | | | |
| | 5 | 2 | | | | | | | | | |
| | 6 | | | | | | | | | 1.8 | |
| San Antonio | 1 | 8.3 | | 7.8 | | 200 | 9.3 | 49 | | 920 | 140 |
| | 2 | 110 | 43 | | | 23 | | 49 | | 6.8 | 2 |
| | 3 | 6.8 | | 7.8 | | 70 | 2 | 14 | 7.8 | 17 | 7.8 |
| | 4 | 4.5 | 2 | | | 2 | | 4 | | 6.8 | |
| | 5 | | | | 2 | | | 7.8 | | 4.5 | 2 |
| | 6 | | | | | | | | 2 | | 2 |
| | 7 | | | | | | | 27 | | 7.8 | 4 |
| | 8 | | 2 | 2 | | 7.8 | | 14 | | 4.5 | |
| | 9 | 13 | | 11 | | | | 7.8 | 7.8 | 4.5 | |
| | 10 | 11 | | | | 130 | | 2 | | 12 | |
| | 11 | 33 | 2 | 49 | 13 | 110 | 21 | 240 | 2 | 1.8 | 11 |
| | 12 | 9.3 | 2 | 13 | | 350 | 21 | 350 | | 2 | NS |
| | 13 | 350 | 4.5 | 240 | 79 | 2400 | 7.8 | 540 | 23 | 13 | 540 |
| | 14 | 14 | | 17 | | 220 | 13 | 11 | 4 | | 7.8 |
| | 15 | 23 | 2 | | | 79 | 4.5 | 6.8 | | 6.1 | 6.8 |
| | 16 | 13 | | 2 | | | | 7.8 | 4 | 2 | |
| Mesquite | 1 | 33 | | | 2 | 2 | | 8.3 | 17 | 2 | |
| | 2 | | | 4.5 | | 23 | | | | | |
| | 3 | 2 | | | | 4.5 | | 2 | 2 | | |
| Aransas | 1 | | | | 4.5 | 2 | | | | | |
| | 2 | 4.5 | | | 1.8 | | | | | | |
| | 3 | 4.5 | 2 | | 1.8 | 2 | | 7.8 | | | |
| | 4 | | | | | | | 4 | | 4.5 | |
| | 5 | 2 | | | | | | 4.5 | | | |
| | 6 | 6.8 | | | | | | 7.8 | | | |
| | 7 | 2 | 2 | 45 | | 4 | | 2 | 4 | | |
| | 8 | | | | | 2 | | | | | |
| | 9 | | | | | 2 | | | | | |
| | 10 | 2 | | | | 11 | 4.5 | 1.8 | | | |
| | 11 | 4.5 | | | | | | | | | |
| | 12 | | | | | 4.5 | | 23 | 2 | 2 | |
| Copano | 1 | 22 | | | | 2 | 4.5 | | | | |
| | 2 | 6.8 | | | | 7.8 | | 7.8 | 2 | | 2 |
| | 3 | 2 | | | | 13 | | 13 | | 2 | |
| | 4 | 7.8 | | 1.8 | | 4.5 | 4.5 | 4.5 | 1.8 | | |
| | 5 | 7.8 | | | 2 | | | | | | |
| | 6 | 4.5 | | | | 7.8 | | 2 | 2 | 13 | 6.8 |
| | 7 | 4.5 | | 2 | | | | 2 | | 4 | |
| | 8 | 14 | | | | 23 | | | | 5.6 | |
| | 9 | 13 | | | | 2 | | 2 | 2 | | |
| | 10 | 1.8 | | | | | | 4.5 | | | |
| | 11 | 7.8 | | | | 1.8 | | 4.5 | | | |
| | 12 | 14 | 2 | 2 | | 11 | | 13 | 2 | 1.8 | 4 |
| | 13 | 23 | | | | | 2 | 4 | 6.8 | 13 | |

NS* Not sufficient sample
Blank Spaces Negative results

Table 6

**Comparison of coliform counts (MPN per 100 ml) of water 50 cm above sediment and sediment surface at San Antonio Bay stations during October, 1959**

| Station Numbers | Water Depth | MPN for 100 ml Sample in Water | Sediment |
|---|---|---|---|
| 1 | 0.5 | 140.0 | 17,000 |
| 2 | 2.0 | 0.2 | 200 |
| 3 | 1.0 | 7.8 | 180 |
| 6 | 2.0 | 0.0 | 200 |
| 9 | 1.2 | 0.0 | 0 |
| 10 | 1.2 | 0.0 | 200 |
| 11 | 0.5 | 11.0 | 450 |
| 13 | 0.25 | 540.0 | 13,000 |
| 14 | 2.0 | 7.8 | 0 |
| 15 | 2.0 | 6.8 | 0 |
| 16 | 2.25 | 0.0 | 0 |

Selected representative profiles of salinity and temperature obtained during March indicated that, in general, the bay water was usually not stratified (Table 7).

In April, (Table 7) more saline water from Espiritu Santo Bay mixed with dilute river water after a heavy rain and caused an increase in salinity in San Antonio Bay. At Stations E-5, E-6, and S-5, in general the lower end of San Antonio Bay, fresh water from the river mixed with highly saline water from Espiritu Santo Bay, providing the only clear salinity profile noted during the survey. Station A-8 represents a typical profile from Aransas, Mesquite, and Copano Bays. Strong winds from either the northwest or southeast continually mixed the water. Water temperatures were usually within 20° C of air temperature signifying a rapid exchange. Table 4 presents minimum, maximum, and average values for chlorinity and temperature at all stations druing the annual survey.

Chlorinity values in bays other than San Antonio were more uniform (Table 4). Espiritu Santo Bay produced the highest chlorinities (7.8 to 16.8 0/00) disclosing the effect of the adjacent Cavallo Pass. Lower chlorinities and higher coliform organism counts noted after rainy periods revealed the effect of the Mission River dilution in upper Copano Bay. Results from stations shown in Tables 8 and 9 are representative of those at which correlation between chlorin-

ity and local rainfall was significant.

Average chlorinities ranged between 9.4 and 12.4 0/00 in Aransas Bay with small seasonal fluctuations. High and low chlorinity figures for A-8, in the center of the bay, suggests the possibility of error as Stations A-1 and A-4 showed no significant increase or decrease in coliform counts.

Characteristic pH values measured in the field and later in the laboratory are compared in Table 10.

Values acquired from field analyses were comparatively higher than those obtained 24-48 hours after sampling by laboratory analyses. The highest pH readings were obtained near the upper end of San Antonio Bay (S-12) which is indicative of the influence of fresh water from the Guadalupe River. Lower values were found at Stations such as A-6 where chlorinity was high. Station A-8 was representative of stations which showed no correlation between pH and other data collected at that site. The pH values were often higher during the winter months than during the summer; presumably due to fluctuations in photosynthetic activity.

Water above the reefs was generally turbid throughout the study period. Apparently, wind stirred the bottom sediments at a faster rate than the oysters cleared it by filtering. Correlation could not be made between turbidity and either water depth or nearness of the river. Light penetration readings are given for selected stations during March, April, and June, in Table 11.

Stations were sampled at approximately the same time of day and light intensity readings were not corrected for fluctuation of cloud cover on some days.

Comparison of MPN of coliform organisms per 100 ml of sample for EMB and BGB media is given in Table 12.

The tests were performed only on the listed samples and were not inclusive for all samples because of time limitation.

## Discussion

Data were compared for salinity, river gauge readings, and coliform organism distribution throughout the annual survey. A significant correlation has been demonstrated to exist between coliform organism abundance and river flow or terrestrial run-off by superimposing Guadalupe River gauge readings on coliform organism counts from Station S-13 (Figure 3). Coliform counts increased or decreased in accordance with the amount of river flow. Coliforms were present in all of the samples taken at stations near the mouth of the river (Table 4). The only station at which coliform organisms were never present were E-3, E-4, and E-6 in Espiritu Santo Bay, stations which were relatively isolated from both river flow and terrestrial run-off and had higher salinities. Stations E-5, A-8, A-9, and A-11 were without coliform organisms except after rain in November and February. Wise, *et al* (1948) report that the coliform organism

**Table 7**

**Selected salinity profiles in Espiritu Santo, Arkansas, and San Antonio Bays on March 20, 1959 and April 28, 1959.**

March 30, 1959

| Water Depth cm | Salinity (0/00) at Stations E-5 | E-6 | S-5 | S-16 | S-4 | A-8 |
|---|---|---|---|---|---|---|
| Surface | 32.6 | 30.0 | 29.5 | 18.4 | 20.7 | 19.2 |
| 30 | | 30.0 | 29.5 | 18.4 | 20.7 | 19.2 |
| 40 | | | | | | |
| 50 | 32.6 | 30.0 | 29.5 | 18.4 | 20.7 | 19.2 |
| 60 | | | | | | |
| 70 | | 30.0 | 29.5 | 18.4 | 20.7 | 19.2 |
| 80 | | | | | | |
| 100 | 32.6 | 30.0 | 29.5 | 18.4 | 20.7 | |
| 150 | 32.6 | 30.0 | 29.5 | 18.4 | 20.7 | |

April 28, 1960

| Water Depth cm | Salinity (0/00) at Stations E-5 | E-6 | S-5 | S-16 | S-4 | A-8 |
|---|---|---|---|---|---|---|
| Surface | 17.5 | 12.5 | 8.5 | 6.9 | 7.5 | 23.5 |
| 20 | | | | | | |
| 40 | 17.5 | 14.0 | | | 7.5 | 23.5 |
| 60 | | 19.4 | 8.5 | | 7.5 | 23.5 |
| 80 | 17.6 | 28.4 | | | 7.6 | |
| 100 | 18.0 | 28.4 | 8.7 | 6.9 | 8.2 | 23.5 |
| 120 | 19.0 | 28.4 | 16.9 | 6.9 | 9.2 | |
| 140 | 19.0 | 28.6 | 23.3 | 16.6 | 11.0 | |
| 160 | 26.0 | 28.6 | 27.5 | 16.6 | | |

**Table 8**

**Rainfall accumulated for seven days prior to collection; average wind velocity and direction for three days preceding collection; and chlorinity vaues for seected stations in Arkansas and Copano Bays.***

| Date | Rainfall (in.) | Stations A-4 | A-8 | A-11 Chlorinity 0/00 | C-4 | C-11 | mph | Wind Direction |
|---|---|---|---|---|---|---|---|---|
| Nov. 23, 1958 | 1.47 | 8.6 | 9.2 | 9.6 | 6.8 | 7.6 | 1 | SE |
| Dec. 18, 1958 | .03 | 9.2 | 4.0 | 10.8 | 8.0 | 7.6 | 2 | NW |
| Jan. 11, 1959 | .65 | 8.8 | 8.8 | 9.6 | 8.8 | 8.0 | 6 | NE |
| Jan. 26, 1959 | 1.10 | 10.0 | 10.8 | 15.2 | 7.6 | 10.0 | 2 | NE |
| Feb. 16, 1959 | 1.97 | 8.8 | 8.0 | 9.6 | 6.8 | 6.8 | 2 | NE |
| Mar. 30, 1959 | .09 | 10.8 | 11.2 | 12.4 | 9.6 | 8.4 | 4 | NE |
| Apr. 28, 1959 | .03 | 10.8 | 9.2 | 12.8 | 8.0 | 8.4 | 15 | SE |
| June 2, 1959 | .11 | 11.8 | 12.0 | 13.0 | 9.6 | 10.0 | 12 | SW |
| July 26, 1959 | .00 | 14.8 | 16.4 | 16.8 | 11.6 | 8.4 | 10 | NW |
| Oct. 7, 1959 | 4.68 | 14.0 | 13.6 | 12.8 | 10.0 | 10.4 | 43 | NW |

*Rainfall and wind values from Rockport Marine Laboratory, Rockport, Texas.

Table 9

**Rainfall accumulated for seven days prior to collection; average wind velocity and direction for three days preceding collection; and chlorinity values for selected stations in Mesquite, San Antonio, and Espiritu Santo Bays.***

| Date | Rainfall (in.) | Stations M-3 | S-6 | S-12 Chlorinity o/oo | E-5 | mph | Wind Direction |
|---|---|---|---|---|---|---|---|
| Nov. 23, 1958 | .87 | 6.8 | 10.8 | 1.6 | 14.2 | | Calm |
| Dec. 18, 1958 | .07 | 8.8 | 8.8 | 1.6 | 16.0 | 2 | NW |
| Jan. 11, 1959 | .33 | 8.0 | 12.0 | 0.8 | 14.8 | 12 | NE |
| Jan. 26, 1959 | .62 | 8.0 | 11.6 | 1.2 | 16.0 | 4 | E |
| Feb. 16, 1959 | 2.28 | 9.6 | 10.5 | 1.2 | 16.4 | 6 | SE |
| Mar. 30, 1959 | .05 | 10.0 | 14.0 | 1.6 | 16.4 | 10 | NE |
| Apr. 28, 1959 | .00 | 11.6 | 13.6 | 0.8 | 16.0 | 16 | S |
| June 2, 1959 | .00 | 10.4 | 12.2 | 1.6 | 15.2 | 3 | SW |
| July 26, 1959 | .35 | 13.2 | 8.4 | 0.8 | 10.8 | 6 | N |
| Oct. 7, 1959 | 5.77 | 14.4 | 10.4 | | 12.8 | 4 | NE |

*Rainfall and wind data from Aransas National Wildlife Refuge, Austwell, Texas.

content of Galveston Bay, located about 100 miles north of Espiritu Santo, was related to volume of water flowing into the Bay. The report states that the percentage of *E. coli* to total coliform flora over oyster beds in Galveston Bay increased from July to November when stream flow was minimal. The percentage decreased markedly in December and January as stream flow increased.

Table 10

**Comparison of results of pH analysis completed in the field and 24-72 hours later in the laboratory.**

| Station | Date | Field Values | Laboratory Values |
|---|---|---|---|
| A-6 | 12-18-58 | 8.6 | 8.1 |
| | 1-11-59 | 8.7 | 7.9 |
| | 1-29-59 | 8.4 | 7.1 |
| | 3-1-59 | 8.5 | 7.9 |
| | 3-30-59 | 8.2 | 6.6 |
| | 4-28-59 | 8.2 | 8.3 |
| | 6-2-59 | 7.3 | 8.2 |
| | 10-7-59 | 6.6 | 8.2 |
| C-11 | 12-18-58 | 8.6 | 8.1 |
| | 1-11-59 | 8.6 | 8.0 |
| | 1-29-59 | 8.4 | 6.1 |
| | 3-1-59 | 8.5 | 7.9 |
| | 3-30-59 | 8.2 | 8.2 |
| | 4-28-59 | 8.2 | 8.2 |
| | 6-2-59 | 8.1 | 8.2 |
| | 10-7-59 | 8.2 | 6.8 |
| S-12 | 12-18-58 | 8.7 | 8.5 |
| | 1-11-59 | 8.5 | 8.2 |
| | 1-29-59 | 8.8 | 8.5 |
| | 3-1-59 | 9.2 | 7.3 |
| | 3-30-59 | 8.7 | 8.4 |
| | 4-28-59 | 8.6 | 8.5 |
| | 6-2-59 | 8.6 | 8.4 |
| | 10-7-59 | — | 8.6 |
| A-8 | 12-18-58 | 8.5 | 8.1 |
| | 1-11-59 | 8.3 | 8.0 |
| | 1-29-59 | 8.5 | 8.0 |
| | 3-1-59 | 8.4 | 8.2 |
| | 3-30-59 | 8.3 | 8.3 |
| | 4-28-59 | 8.6 | 8.6 |
| | 6-2-59 | 8.2 | 8.2 |
| | 10-7-59 | 8.3 | 6.9 |

Coliform organism counts were highest when high river flow followed a long period of low gauge readings, such as during February and March in San Antonio Bay. A direct relationship between coliform organism counts and fresh water dilution from the river appears to exist in San Antonio Bay during November, 1958, and July, 1959 (Figures 4 and 5). Heavy rainfall during December and March decreased coliform organism content throughout the bays including Stations S-12 and S-13. It is assumed that frequent heavy rains, resulting in a dilution of the water, also lowered the coliform organism content per unit of water. The effect of river dilution by river flow could not be separated from dilution caused by rainfall at stations near the mouth of the river. Rainfall had a significant effect upon salinity changes in Aransas and Copano Bays (Table 8) but had no recognizable effect on Mesquite, Espiritu Santo or San Antonio Bay (Table 9). Low salinity in Aransas and Copano Bays was correlated with high coliform organism counts except during October (Table 5). In April, when there was little rainfall but high river gauge readings, coliform numbers were above average at nearly all stations.

Table 11

**Light penetration during March, April, and June, 1959, at representative stations as measured by a photoelectric cell.**

| Station | Light Penetration (cm) March | April | June |
|---|---|---|---|
| S-9 | 100 | 40 | 100 |
| S-13 | Surface | 40 | 60 |
| S-6 | 100 | 100 | 100 |
| E-5 | 100 | 40 | 100 |
| C-10 | 100 | 100 | 100 |
| A-8 | 100 | 40 | 60 |
| A-12 | 50 | 20 | 60 |

**Light penetration in San Antonio Bay on April 29, 1959.**

| | cm |
|---|---|
| S-1 | 80 |
| S-2 | 40 |
| S-3 | 20 |
| S-4 | 40 |
| S-5 | 40 |
| S-6 | 100 |
| S-7 | 40 |
| S-8 | 20 |
| S-9 | 40 |
| S-10 | 60 |
| S-11 | 40 |
| S-12 | 20 |
| S-13 | 40 |
| S-14 | 60 |
| S-15 | 60 |
| S-16 | 40 |

Salinity fluctuated in all of the bays during the survey. Two fresh water distribution patterns were evident in San Antonio Bay (Figures 4 and 5).

Table 12

**Comparison of Most Probable Numbers of coliform organisms per 100 ml of sample by EMB and Brilliant Green Bile Media.**

| Station | Date | EMB | BGB |
|---|---|---|---|
| M-3 | 12-16-58 | 2 | 0 |
| E-4 | 12-16-58 | 2 | 0 |
| C-5 | 12-18-58 | 2 | 0 |
| S-2 | 12-18-58 | 9.1 | 43 |
| S-13 | 12-18-58 | 2 | 4.5 |
| A-7 | 1-11-59 | 26 | 45 |
| A-9 | 1-11-59 | 2 | 11 |
| M-2 | 1-11-59 | 11 | 4.5 |
| E-4 | 1-11-59 | 4.5 | 0 |
| S-1 | 1-11-59 | 2 | 7.8 |
| S-3 | 1-11-59 | 6.8 | 7.8 |
| S-11 | 1-11-59 | 4.5 | 49 |
| S-12 | 1-11-59 | 9.1 | 13 |
| S-13 | 1-11-59 | 11 | 240 |
| S-14 | 1-11-59 | 4 | 17 |

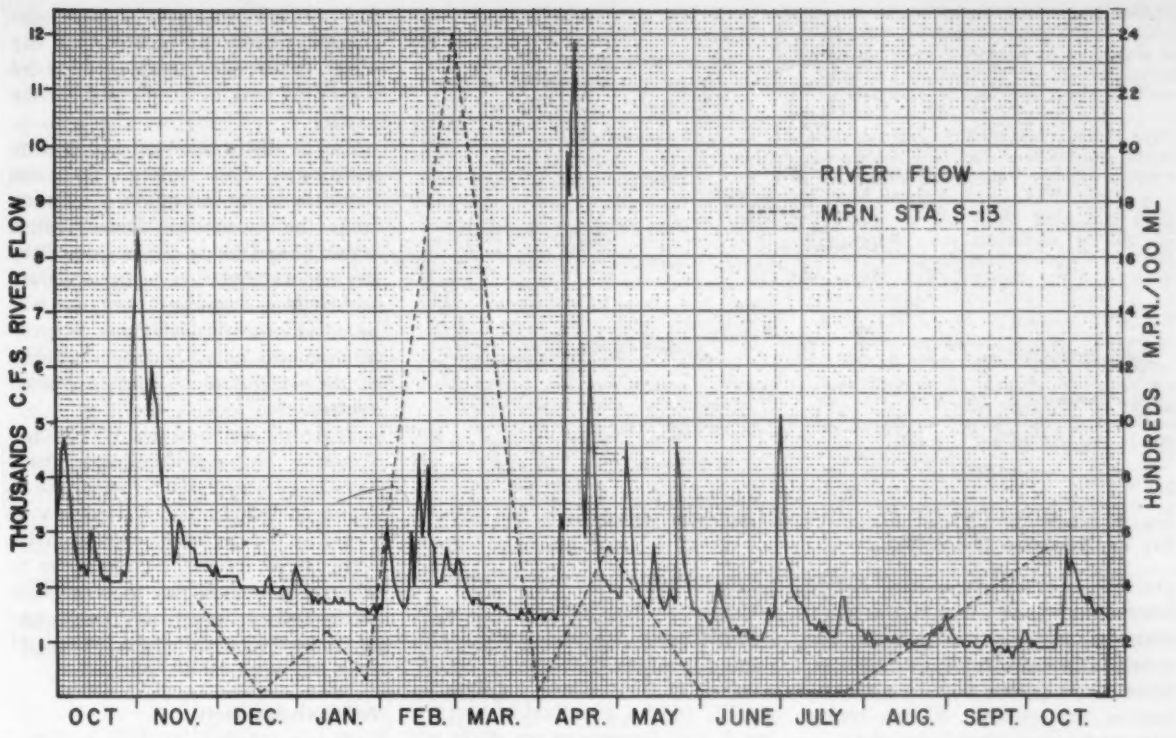


**Fig. 3. RIVER GAUGE READINGS for Mission, Gaudalupe, and San Antonio Rivers during the period from November, 1958 to October, 1959.**

Salinity changes relevant to fresh water passing along the northeast side of the bay as compared to the southwest side may have been caused by wind action since there was no appreciable change in tide. Northwest or southeasterly winds constantly mixed the water, and salinity profiles were encountered rarely except in April due to the influx of saline water which diluted the more fresh water in San Antonio Bay after the heavy April rains (Table 7). At Stations E-5, E-6, and S-5 at the lower end of San Antonio Bay, fresh water from the river mixed with highly saline water from Espiritu Santo Bay, providing the only clear salinity profile (Table 7).

Analyses of coliform organism data from stations near various towns located along the bays depicts little or no significant influence from sewage treatment plant effluent, with possible exceptions being July measurements at Seadrift (S-1). However, this Station was within close proximity of the mouth of the river and it is difficult to establish which source caused the increase. On the basis of salinity distribution it seems likely that the primary derivation of coliforms was from river effluent.

In comparing the 1938 study (Table 3) with the present survey (Table 5), river flow appeared to be responsible for high coliform organism counts in upper Copano and San Antonio Bays. There was a similar disappearance of coliform organisms in Mesquite Bay from December to March in both studies. To justify any conclusions from comparison of data it would be necessary to know the annual river gauge readings for 1938 which are not available.

High coliform organism counts in the water occurring after wind or weather change may also be attributed to suspension of coliform organism from the sediments due to wave action on the bottom. At the river entrance, sediments contained significantly higher numbers of coliform organisms than found in the water directly above the sediments. Counts were progressively lower in sediments at stations further away from the river. Usually, suspended materials are precipitated when fresh water having a high pH mixes with sea water of a lower pH. It is possible that coliform organisms were entrapped in the precipitating material from the turbid bay water and concentrated in bottom sediments (Wise, *et al*, 1951). Photometer readings (Table 11) indicate that bay water was highly turbid throughout the study period, especially in San Antonio Bay. No relationship was determined betwen turbidity and coliform organism counts. Even though coliform counts were greater at the mouth of the river, these counts are relatively low when compared with normal bacterial flora present in marine water which may reach 100 million bacteria per ml. The comparatively low numbers may be indicative that the coliform organisms were not actively reproducing in the sediments.

pH values obtained by field analyses were constantly higher than those obtained later from the same samples after laboratory analysis (Table 10). Production of carbon dioxide from metabolic activities during the 24-72 hour lapse between time of collection and laboratory analysis explains the low laboratory values. The difference between pH values in the field and laboratory is possibly a measure of biological activity *in situ* conditions.

ZoBell (1946), and Ketchum (1952) among others, have considered that natural sea water has an inhibiting action responsible for sup-

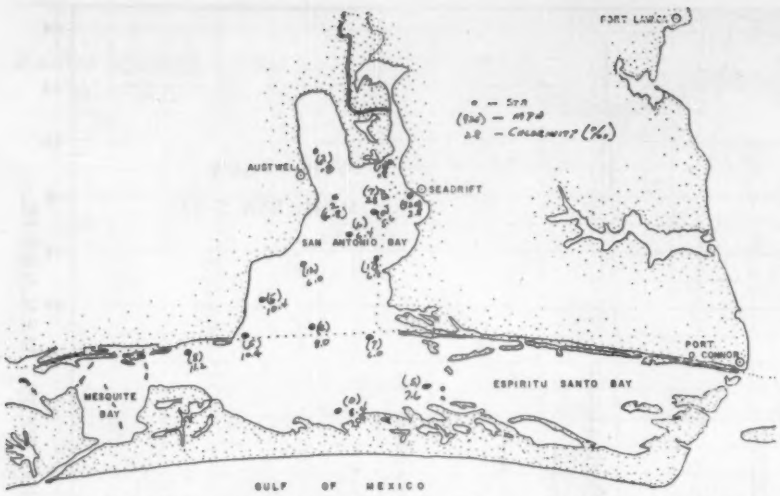


**Fig. 4. DISTRIBUTION OF SALINITY and coliform organisms in San Antonio Bay on November 23, 1958.**

pressing coliform organisms. Ketchum further evinced that *E. coli* originating from terrestrial sources disappear at a more rapid rate than dilution takes place; thus in a natural marine environment *E coli* cannot survive for more than a few days.

Determination of *E. coli* distribution requires the use of complex testing methods, whereas examination of marine water or sediments for the presence of coliform organisms employing the Standard Method for the Examination of Water and Sewage provides a measurement only of coliform distribution. Because of the existence of many lactose positive organisms in normal marine environments which may give positive coliform presumption results, it is difficult to relate *E. coli* distribution to coliform distribution. Rittenburg, Mittwer, and Ivler (1958) have verified that the standard brilliant green bile test does not conclusively confirm the presence of coliform organisms in marine water or sediments. Their opinion is based on failure to confirm the presence of coliform organisms in EMB agar from positive lactose tubes when positive confirmation was obtained using the brilliant green bile medium. The data in Table 12 indicate that when the results from BGB tests indicate less than 10 coliform organisms per 100 ml that the EMB results from the same sample may either be higher or lower. However, when the BGB count is above 10 coliforms per 100 ml, the EMB results may be considerably lower. These data lend support to Rittenburg's skepticism of the Standard Procedure for the determination of coliform organisms as a valid method for the determination of *E. coli* in the sea. Tennant, Reid, and Rockwell (1960) as a result of their research employing the EC (44.5 C) method of confirming *E. coli* densities in sea water and shellfish, conclude that the test is not a suitable replacement of the standard method.

## Conclusions

1. Coliform organisms were found at least once during the survey at all stations except E-4, E-5, and E-6 in Espiritu Santo Bay. The occurrence of coliform organisms was related to rainfall and river flow; counts were higher after a rain and when river gauge readings were high. Apparently, coliform organism content decreased rapidly in numbers in bay water. Coliform organism increase did not occur near towns located on the bayside.

2. The distribution of coliform organisms in San Antonio Bay was found to be an indication of dilution from the Guadalupe River. Fresh water flowed along either side of the bay and a correlation between salinity and coliform organism abundance was noted at individual stations. No correlation was noted between turbidity of the water and coliform organism content.

3. At the mouth of the river in San Antonio Bay, coliform organisms were more numerous in the surface of sediments than in the overlying water.

4. The pH decreased when samples were stored for 24-72 hours prior to laboratory analysis due to metabolism of the enclosed organisms. Fresh water from the rivers have a higher pH than the more saline Gulf water.

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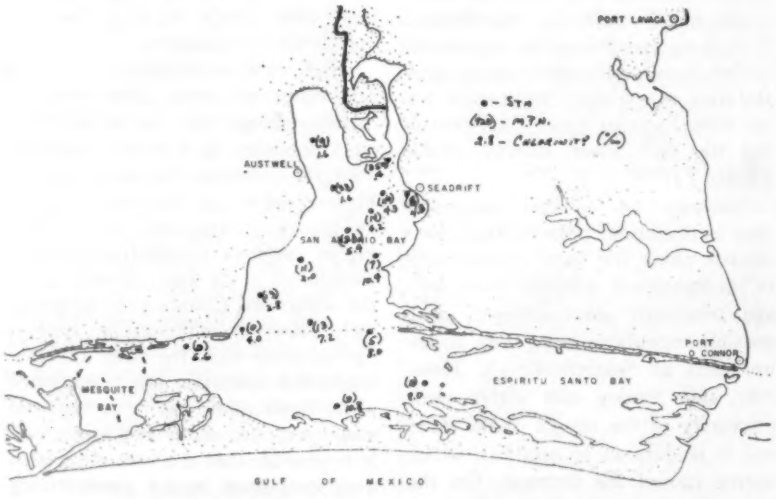


**Fig. 5. DISTRIBUTION OF salinity and coliform organisms in San Antonio Bay on July 26, 1959.**

tary Engineering, directed by Mr. G. R. Herzik, for aid in selecting stations, supplying the 1938 report, river flow data, oyster harvesting records, and for assistance in editing this paper. The staff of the Rockport Marine Laboratory of the Texas State Game and Fish Commission also gave valuable field assistance.

Routine coliform, pH, and chlorinity analyses were conducted by the Corpus Christi-Nueces County Health Department. Dr. John Conover, Woods Hole Associates, provided the unit used during this study for measuring salinity profiles, temperature, and light penetration. He also assisted in the collection of data.

Support, in part, was also provided by PHS Grant RG-5885, Microbial Ecology.

**References**

Carlucci, A. F. and David Pramer. An evaluation of factors affecting the survival of *Escherichia coli* in sea water. App. Microbiology, 4:247 (1960).

Collier, Albert and Joel W. Hedgpeth. An introduction to the hydrography of tidal waters of Texas. *Publ. Inst. Mar. Sci. Univ. Tex.*, 1:121 (1950).

Greenburg, Arnold E. Survival of enteric organisms in sea water. Publ. Health Rept. 71:77 (1956).

Haneman, A., Jr., Preliminary Sanitary Survey Report of Espiritu Santo Bay, San Antonio Bay, Mesquite Bay, Aransas Bay, and Copano Bay. Texas Department of Health, Austin, Texas. (1938).

Ketchum, Boxtwick H., John C. Ayers, and Ralph F. Vaccaro. *Ecology*, 33:247. (Processes contributing to the decrease of coliform bacteria in a tidal estuary.) 1952).

Odum, Howard T. and Charles M. Hoskin. Comparative studies on the metabolism of marine waters. *Publ. Inst. Mar. Sci. Univ. Tex.*, 5:16. (1958).

Orlob, Gerald T. Viability of Sewage bacteria in sea water. *Sewage and Industr. Wastes*, 28:1147-1167. (1956).

Parsons, Payn B. Report of committee on standard methods for the bacteriological examination of shellfish. *Amer. J. Publ. Health*, 12:574. (1956).

Rittenburg, S. C. T. Mittwer, and D. Ivler. Coliform bacteria in sediments around three marine sewage outfalls. *Limnol. and Oceanogr.*, 3:101. (1958).

Tennant, A. D., J. E. Reid, and L. J. Rockwell. An evaluation of the EC (44.5°C.) confirmation test for the estimation of *Escherichia coli* densities in sea water and shellfish. (1960).

Weiss, Charles M. Adsorption of *E. coli* on river and estuarine silts. *Sewage Industr. Wastes Engn.*, 23:227 (1951).

Wise, Robert L., Joe B. Winston, and George Culli, Jr. Factors of sewage pollution of oyster beds in Galveston Bay. *Amer. J. of Publ. Health*, 38:1109. (1948).

ZoBell, Claude E. Marine Microbiology. A Monograph on Hydrobacteriology. Chronica Botanica Co., Waltham, Mass., i-xv, 1-240 pp. (1946).

## Aqua-Chem Announces New, Low Cost Conversion Process

Aqua-Chem (formerly Cleaver-Brooks Special Products), manufacturer of flash evaporation and vapor compression sea water conversion equipment, announced commercial availability of a new electrodialysis process to convert brackish water into fresh water at a cost substantially below that possible with any equipment currently in operation.

According to operating reports, the process, developed by a scientific research organization in the Netherlands, has actual conversion costs of 54 cents per thousand U.S. gallons at a 2,800,000 gallon a day brackish water plant for gold mines in southwest Africa. The cost figure is based on a 15 year program for the redemption of capital and accumulation of interest.

For comparison, a figure of 35 cents to 50 cents per 1,000 gallons is commonly used as an average cost of delivering conventional fresh water to consumers in the United States.

Significantly, this marks the first time that any manufacturer of large saline water conversion equipment is able to offer either evaporating water conversion or electrodialysis equipment, whichever suits the application best, and thus provide unprejudicial counsel for the user.

In the electrodialysis process, brackish water is fed between two ion permeable membrances and an electric current is passed through the cell. The membranes are so designed that one is selective to positively charged ions and the other to negatively charged ions. One membrane passes negative ions and the other positive ions with the result that the water in the stream between the membranes becomes purified while the water on the opposite sides of the membranes become concentrated with salinity.

The Netherlands organization which developed the process is known as T.N.O., an abbreviation Toegepart Natuurwetenschappelijk Onderzoek. Under the agreement with T.N.O., Aqua-Chem has exclusive manufacturing rights in North America and has access to the full store of T.N.O.'s years of accumulated data and experience. Aqua-Chem will engineer, manufacture and sell the new equipment at its Waukesha plant.

It is anticipated by Aqua-Chem officials that the electrodialysis equipment will not be used for sea water conversion at this time. Rather, it is expected to find wide municipal and commercial applications in such states as South Dakota, North Dakota, Arizona, New Mexico, Texas, Oklahoma, Nevada, Colorado and Kansas where brackish waters are a problem.

The process will also have wide application in the chemical, paper, plastics and related industries where material concentrations are prevalent.

This milestone by Aqua-Chem is another step geared to keep the company in the forefront in the sea water conversion field.

Aqua-Chem, an affiliate of Cleaver-Brooks Company, designs, engineers, and fabricates distillation equipment for world-wide municipal, pharmaceutical, marine and government applications.

Today, the company has water converting plants located throughout the world. Many are found in water scarce areas in the Middle East, South America, Africa and islands in the Pacific. Recently installed was sea water desalting equipment for Wake Island, Salinas, Ecuador, and Gibraltar. The company's 100,000 gallon a day unit at Southern California Edison's Mandalay steam station is operating well over capacity, while fabricating operations are almost completed for a 270,000 gallon a day plant for the Virgin Islands.

## Basement Flooding Prompted New Specifications in Missouri

Flooding of basements by infiltration of storm water into sanitary sewer lines in St. Louis County resulted in authorization of new specifications by the District's Board of Trustees.

This authorization provides that joints for sanitary sewers, 21 inches in diameter or smaller, shall be factory molded compression joints on vitrified clay pipes.

"The use of factory-applied polyvinyl chloride joints will reduce infiltration to . . . a minimum, or . . . eliminate infiltration entirely," according to Director Peter F. Mattei.

# Pollution — Urban Vs Rural in Imperial Valley Waters — *Part II*

by HARVEY F. LUDWIG
ANDREW L. GRAM
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## Condition of Receiving Waters

THE RIVERS of the Imperial Valley are quite heavily polluted, but because they are not used for water supplies or recreational purposes, and because they have not been the source of nuisances, there has been no particular incentive to improve their quality. The Salton Sea, however, is now subject to considerable recreational use, especially in its northern portion, and there is some danger that bacterial contamination entering the Sea from the rivers might constitute a public health hazard. In order to determine the probable effect of any pollution control measures, the past and present chemical and biological characteristics of the bodies of water in question must first be evaluated.

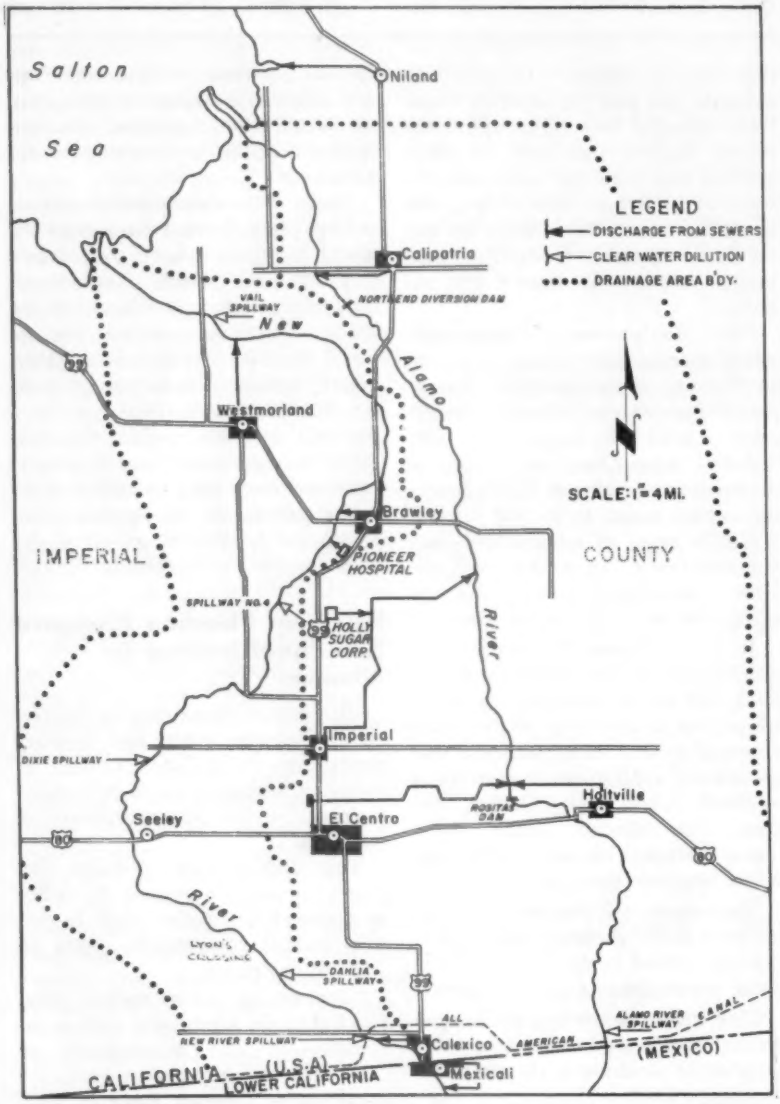



Fig. 1. IMPERIAL VALLEY stream pollution sources.

### New River

Several significant characteristics of the New River are shown in Figure 2, plotted along the stream course from the Mexican border to the Salton Sea. The four items, quantity of flow, dissolved oxygen, BOD, and coliform concentration, are averages of 3 or 4 measurements taken in 1951-52 at intervals of several months, as given in Reference 1.

The volume of flow in the New River is seen to increase from a small value at the border to more than 750 cfs at the river mouth. The increase in the stream flow is rather uniform; there is almost a linear relation between flow and distance downstream. Some water enters the river as overflow from five main canal spillways spaced along the river, but most of the flow is agricultural drainage. Since 1954 the total main spillway overflow in the New River has averaged only about 3 per cent of the total. The average annual flow at the mouth has remained fairly constant at about 600 cfs, but since 1954 the inflow from Mexico has risen from about 6 per cent of the total to over 20 per cent. Agricultural drainage, diluted by some overflow from lateral irrigation canals, makes up approximately 75 per cent. An unknown fraction of the drainage flows into the river directly from the ground water. Sewage effluent discharges make up a very small and negligible portion of the river flow.

The monthly flow variation of both the New and Alamo Rivers is shown in Figure 4. Irrigation practice is clearly reflected; there are peak flows in the spring and fall, which are the

principal growing seasons. In August and February there are minima corresponding to periods when much of the land is being prepared and seeded. Some irrigation is performed all year, however, and the monthly flow variation is not great, especially in the New River; the maximum month, October, has a flow equal to 122 per cent of the year's average, and in February, the minimum month, the flow is 84 per cent of the average.

Biochemical Oxygen Demand: The BOD concentration at the border, 27 ppm, is very high for river water. It rapidly falls off downstream, however, and remains in the neighborhood of 4 ppm for most of the river's length. In a very sluggish stream a BOD of 4 ppm might be sufficient to cause anaerobic conditions with resulting odors, but the New River flows rapidly (average velocity about 2 feet per second) and continuously reaerates itself. Although the dissolved oxygen concentration is very low near the border, it increases steadily until it reaches saturation. The high BOD and low dissolved oxygen near Calexico are apparently due to the heavy load of Mexicali sewage entering immediately above, combined with the low river flow at that point. The dissolved oxygen concentration occasionally drops to zero in the Calexico reach, and it is the only part of either the New or Alamo Rivers in which there is any odor nuisance or unsightliness.

Coliform Concentration: The coliform data show considerable irregularity, as is characteristic of bacteriological sampling; however three sets of data were available, which show a progressive increase in coliform concentrations between 1946 and 1958. Large MPN's were found near the border, which can be attributed to Mexicali sewage. There are smaller peaks near the old El Centro outfall and opposite Brawley. The die-off of the bacteria is seen to be rapid, so that between the peak points and at the mouth of the river the coliform density has fallen to about 5,000 per milliliter.

From the various sanitary analyses it is clear that although the waters of the New River are highly polluted and unfit for human consumption or recreational use, there are no associated nuisances except immediately below Mexicali, where the self-purifying capacity of the stream

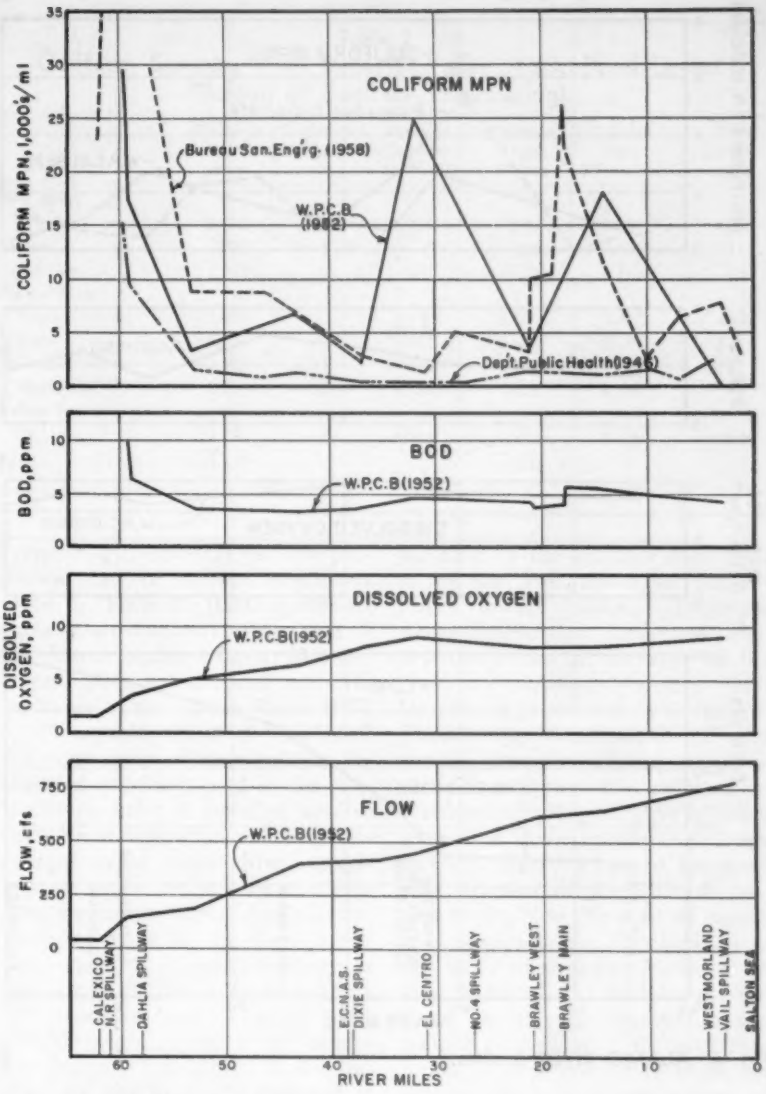



**Fig. 2. NEW RIVER profiles.**

is at times exceeded. The river flows rapidly and carries a heavy load of silt; it has an opaque beige color along its entire length, making it impossible to detect the presence of solids of sewage origin.

### Alamo River

Figure 3 shows profiles of the quantity of flow and concentration of dissolved oxygen, BOD, and coliform organisms along the Alamo River.

The stream flow coming from Mexico is negligibly small, and the first important tributary flow is from the All American Canal spillway near the border. The size of the stream increases only slightly between the spillway and Rositas Dam; most of the drains in that region run parallel to the river and enter farther downstream. After Rositas the flow rapidly increases, and at the river mouth amounts to about 1,000 cfs. The spillway overflow and inflow from Mexico are rather variable, but agricultural drainage and lateral canal spillage generally account for about 90 per cent of the water reaching the Salton Sea from the Alamo River. Formerly some water was diverted for irrigation at Rositas and North End Dams, but the water has become too saline to continue that procedure.

The BOD concentration averages about 2.5 ppm, and reaches a maxi-

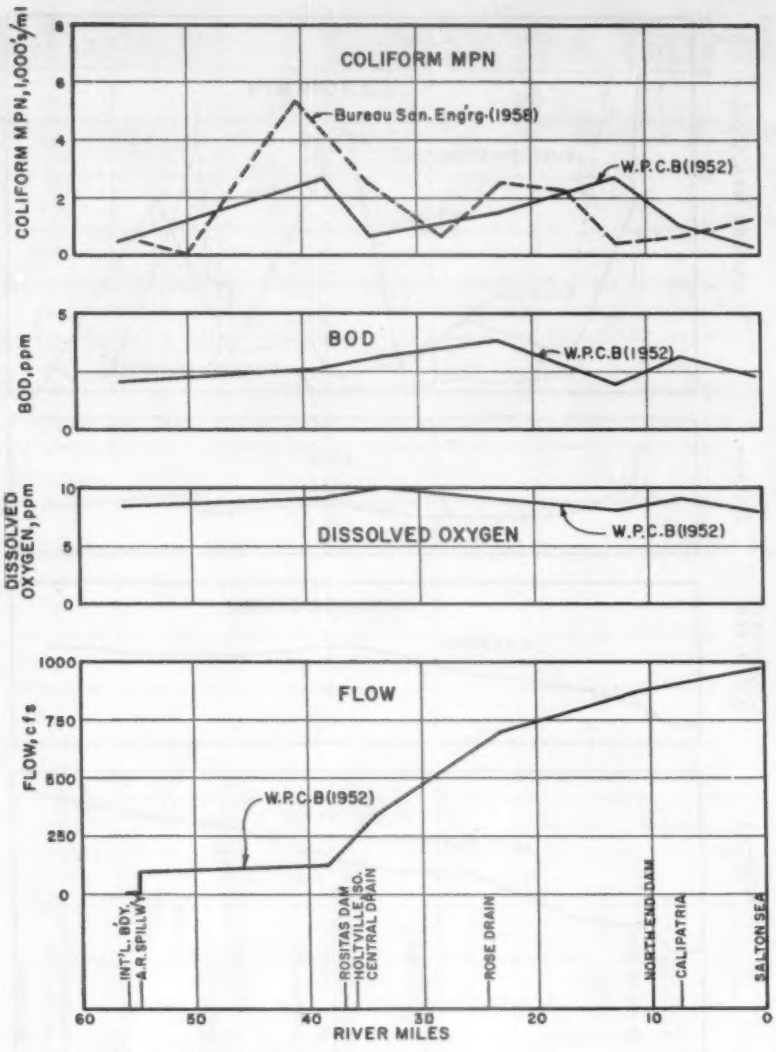



Fig. 3. ALAMO RIVER profiles.

mum of only 4 ppm at the confluence of the river with Rose Drain. The oxygen level is close to saturation at all points, indicating the self-purifying capacity of the Alamo River is far greater than that necessary to take care of the present pollutional load.

Coliform concentrations in the Alamo River are in general considerably lower than in the New River. There is a peak above Rositas Dam, which probably corresponds to drainage combining with the low river flow in that reach. Other peaks downstream of Rositas are also apparently due to field drainage.

### Pollution Loadings Discharged to Salton Sea

The quantities of BOD and coliform organisms being carried by the New and Alamo Rivers, based on measurements made on river water samples (Reference 1) are shown in Figure 5.

In the New River the BOD load increases gradually along its length until there are some 24,000 lb/day reaching the Sea. The coliform flow, on the other hand, varies widely. It reaches a maximum of about 350 x $10^9$ organisms/second, but only discharges about 70 x $10^9$ organisms/second to the Sea. The reason for the rapid changes in coliform load is the natural die-off which the coliform bacteria undergo when exposed to the unfavorable environment of the river. At a velocity of 2 feet per second it requires about two days for water crossing the border to pass into the Salton Sea. In this time more than 95 per cent of the original coliforms will have perished. Organisms are entering all along the way, however, so that the concentration at any point may be quite large. Brawley's main outfall is 18 miles from the river mouth, or about one-half day of flow time; for these conditions more than 80 per cent of the sewage bacteria discharged by Brawley can be expected to die off before reaching salt water. BOD is also continuously destroyed along the course of the stream but at a much slower rate. The overall reduction in BOD entering the New River would be of the order of 25 per cent.

The Alamo River carries a slightly lower BOD load than the New River and a much smaller coliform load. The BOD tends to increase downstream, but near the lower end fluctuates at around 12,000 lb/day. The peak coliform concentrations is 70 x $10^9$ organisms/second, but only about 15 x $10^9$ organisms/second are discharged to the Sea.

Biochemical Oxygen Demand Balance: In comparing the BOD loads in the rivers with the estimated BOD production from known sources listed in Table I, it is apparent that there are other important sources. The total of the individual BOD discharges now reaching the southern Salton Sea from both the New and Alamo Rivers, as shown in Table I, is 15,500 lb/day, and some of this is destroyed by natural purification processes in the drains and rivers. Yet the total measured BOD discharge (obtained by multiplying the BOD concentration at the rivers' mouths

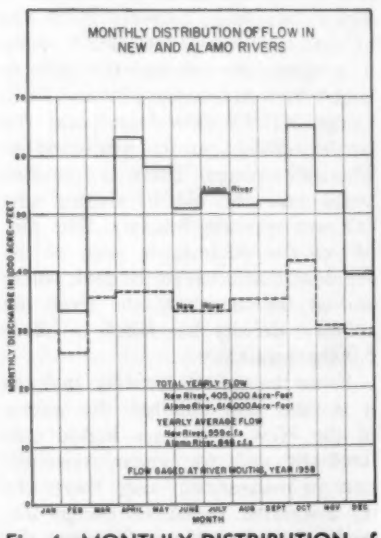

MONTHLY DISTRIBUTION OF FLOW IN NEW AND ALAMO RIVERS
MONTHLY DISCHARGE IN 1000 ACRE-FEET
Alamo River
New River
TOTAL YEARLY FLOW
YEARLY AVERAGE FLOW
FLOW GAGED AT RIVER MOUTHS, YEAR 1958
JAN FEB MAR APRIL MAY JUNE JULY AUG SEPT OCT NOV DEC
MONTH

Fig. 4. MONTHLY DISTRIBUTION of flow in New and Alamo Rivers.

by the flows in the rivers) in 1952 was 36,000 lb/day, leaving at least 20,000 lb/day unassigned. Presumably this is due to agricultural and/or natural sources. For the New River alone, the BOD in the river at its mouth in 1952 (24,000 lb/day) is about twice the amount estimated as originating from sewage discharges at that time.

Coliform Balance: Because the rate of die-off of coliforms is variable as well as rapid, and very sensitive to slight changes in environmental conditions, it is not possible to make a quantitative evaluation of the sources of coliform organisms in the same manner described above for BOD. Certain peaks in coliform density (Figure 2) can be associated with sewage discharges, but the percentage of the coliform organisms found in the Salton Sea which originated in sewage cannot be determined from the bacteriological tests made of samples from the Sea itself. However, the agricultural drains have been sampled to some extent for coliform organisms by both the State Department of Public Health's Bureau of Sanitary Engineering (Reference 2), and by the Regional Water Pollution Control Board[8]. The Reference 2 data, which represent samples taken at the mouths of the drains, are presented in Table 2. In addition to the samples in Table 3, the outlets of several tile drains were also sampled, and were found to have very low coliform densities.

By comparing Tables 2 and 3, it is noted that both show lower counts in the New River drains than in the Alamo drains, presumably due to the shorter lengths of the New River drains. Also, the Regional Board's samples gave coliform densities of considerably lower magnitude than those of the Bureau of Sanitary Engineering, especially in the Alamo River. The difference may be accounted for in part by the correlation observed between coliform densities and length of drains, the densities in the drains being roughly proportional to the total lengths of the drains tributary to the point of sampling. For this reason, as well as the fact that the Bureau data are considerably more recent and more extensive with respect to numbers of samples taken at each sampling point, the Bureau's data is considered to be the more representative.

Table 2
**Coliform Samples from Imperial Valley Agricultural Drains (Bureau of Sanitary Engineering)**

| Drain | Drainage Area, acres | Eestimated Flow cfs | Average Coliform MPN/ml | Coliform Flow $10^6$/sec | Coliform Flow $10^6$/sec/acre | Drain Length miles |
|---|---|---|---|---|---|---|
| **New River** | | | | | | |
| Fillaree | 7,900 | 35 | 235 | 230 | 0.029 | 16.5 |
| Best | 900 | 4 | 7 | 0.8 | 0.0009 | 3 |
| Trifolium 11 | 1,900 | 9 | 870 | 220 | 0.116 | 5.5 |
| **Alamo River** | | | | | | |
| South Central | 20,600 | 50 | 6,430 | 9,100 | 0.442 | 51.5 |
| Rose | 39,700 | 50 | 3,970 | 5,600 | 0.141 | 72 |
| Orita | 3,300 | 15 | 610 | 260 | 0.079 | 10 |
| Mulberry | 2,700 | 15 | 1,230 | 520 | 0.193 | 9 |
| **Salton Sea** | | | | | | |
| "R" | 2,300 | 5 | 4,060 | 570 | 0.250 | 5.5 |
| Total | 79,300 | | | 16,500 | | |
| Average | | | | | 0.209 | |

Applying the average per-acre production rate of coliform organisms given by Table 2 (0.209 x $10^6$ organisms/acre/second) to the area of the Alamo drainage basin (355,000 acres) gives a calculated coliform discharge to the Alamo River of 77 x $10^9$ organisms/second. This is of the same order of magnitude as the observed maximum load in the Alamo River, and it is therefore possible that the sewage effluents being discharged to the Alamo River contribute a minor fraction of the coliform organisms therein. Applying the same technique to the New River, the computed coliform discharge at the mouth of the river is 0.209 x $10^6$ organisms/acre/second times 190,000 acres, or 40 x $10^9$ organisms/second. This is considerably less than the heavier peaks observed in the New River, but of the same magnitude as the actual loading at the mouth of the river.

Summary: The coliform data indicate that in both the New and Alamo Rivers the coliform contributions from agricultural sources are of the order of magnitude of the total coliform loadings delivered to the Salton Sea, and in the Alamo River these agricultural sources probably account for most of the loadings discharged to the Sea. The New River also receives sewage coliform discharges whose magnitudes, immediately below the points of discharge to the river, are considerably greater than for the agricultural discharges. These sewage organisms die off very rapidly, however, whereas the agricultural coliforms are indicated to "accumulate" along the river in rough proportion to the volume of drainage received. Hence it cannot be stated what fraction of the coliform content of the New River at its mouth is of sewage origin. On the basis of the BOD observations, however, it may be stated that the sewage coliforms probably do constitute a significant proportion of the total coliforms. If in proportion to BOD, the sewage and agricultural sources of coliforms would be indicated to be about equal.

For a definite resolution of the question of how much of the coliforms discharged to the Sea by the two rivers are of sewage origin, it would be necessary to undertake a sampling survey in which not only the coliform index would be determined, but also the concentration of a specific sewage organism, such as

Table 3
**Coliform Samples from Imperial Valley Agricultural Drains (Regional Board)**

| Drain | No. of Sampling Points | Total Estimated Flow cfs | Coliform MPN/ml Max. | Min. | Aver. | Total Coliform Flow, $10^9$/sec |
|---|---|---|---|---|---|---|
| New River | 11 | 77 | 700 | 0.62 | 285 | 620 |
| Alamo River | 15 | 805 | 700+ | 23 | 410 | 9,300 |
| Salton Sea | 4 | 65 | 240 | 62 | 90 | 165 |

*E. coli*. Such a survey might properly be undertaken by an agency having Valleywide interests, such as the State or County Health Department, or the Regional Water Pollution Control Board.

### Conditions in the Salton Sea

Coliform determinations in the Salton Sea have been carried out by several public agencies, especially by the State Department of Public Health (Reference 2) and by the Department of Water Resources, published in Reference 1. The data of Reference 2 are particularly extensive, and from them it was possible to draw the contours of coliform density shown in Figure 6. These contour lines represent, not the average coliform densities for all the samples taken, but the concentrations exceeded by 20 per cent of the samples. As noted, this is a more meaningful criterion of pollution than the average for all the samples.

The area of heaviest density is seen to be centered around the mouth of the Alamo River, and extends for a considerable distance along the east shoreline north of the Alamo mouth. West of the New River, the coliform infested region extends only a short distance, and it is probable that the prevailing westerly winds tend to move the surface water toward the east. The bottom drops off more rapidly near the New River mouth, and because of the greater opportunity for mixing and dilution in that area, the coliform organisms in the area northeast of the Alamo River mouth, in the direction of Bombay Beach, may be coming entirely from the Alamo River, the New River having already dispersed its heavier coliform burden.

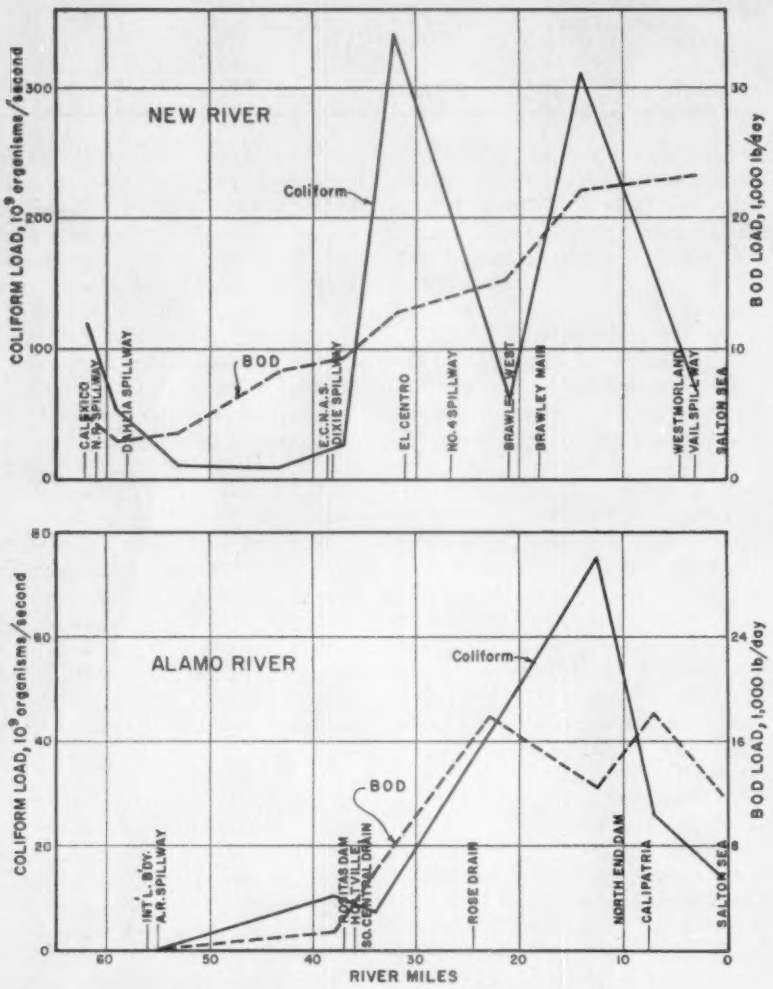



**Fig. 5. POLLUTION LOAD of New and Alamo Rivers.**

In addition to the two rivers, the southern Salton Sea receives the discharge of numerous agricultural drains. The stretch of shoreline perforated by drains corresponds roughly to the area of high coliform density, and it is significant that the drain mouths on the east shoreline extend considerably farther north than on the west shoreline. The heaviest concentrations of bacteria are in the waters immediately adjacent to the shore. Probably the shallow water, which limits dilution and mixing with the main body of the sea, together with the onshore wind are responsible for this condition. It is quite possible, therefore, that the agricultural drains discharging directly into the Sea may be more responsible for the high coliform concentrations along the beach than the discharges of the two rivers.

The presence of coliform group organisms *per se* does not prove the organisms are derived from sewage sources, and it has also been indicated that the coliform discharge of the Alamo River is primarily of agricultural origin. Since it is also indicated that the coliform discharge of the New River, which probably does contain a considerable fraction of sewage-derived organisms, is dispersed in the vicinity of the New River mouth, it is likely that the discharges of the New and Alamo Rivers pose little if any health hazards to the areas of the Sea now being used for recreation. It may also be concluded, however, that the beach waters in the vicinity of the mouth of the New River contain significant concentrations of sewage-derived coliforms, and on this basis it may be argued that cities discharging sewage to the New River should provide some sewage treatment facilities. This would be particularly true for Brawley, because of its proximity to the Sea. The degree of treatment indicated is no more than primary, i.e., removal of settleable and floatable solids, since it is this fraction of the total solids of sewage which is the most important with respect to persistence of coliforms. The settleable and floatable solids both would tend to protect these organisms from adverse influences in the river environment and hence prolong their existence, as compared with the organisms contained in the effluent from primary clarification.

With respect to the effect of BOD loadings discharged to the Sea, it is noted that dissolved oxygen in the Sea is always near saturation at the surface. During certain times of the year the bottom in deep water becomes anaerobic, but in shallow water there is always some oxygen present. Since the only recreational use of the southern part of the Sea is some hunting, there appear to be no adverse effects attributable to any present pollution other than the possible danger to public health.

## Summary and Conclusions

The southern end of the Salton Sea is fed by the New and Alamo Rivers, and by independent agricultural drains. The rivers are turbid and fast-flowing, and capable of absorbing considerable quantities of sewage materials without visible evidence of nuisance. In 1958 the New River flow averaged about 559 cfs, and the Alamo River about 848 cfs. Agricultural drainage is the origin of most of the water in both rivers; irrigation overflows constitute the remaining fraction. The volumes of the sewage contributions are negligible.

There is no significant use of the rivers or the southern portion of the Sea for water supplies or for water-contact recreation. There are limited hunting and fishing activities. Along the east, west, and northern shores of the Sea there is an expanding recreational activity; however, the most southerly of the currently used beach areas is Bombay Beach, 12 miles to the north of the Alamo River mouth.

Sources of sewage pollution in the New River which can be estimated accurately are the cities of Mexicali, Calexico, Brawley, and Westmorland; the El Centrol Naval Air Station, and the Pioneer Memorial Hospital. Loadings from other sources, namely streamside cattle feed yards, farm labor camps, and rural sewage discharges, can be only roughly estimated but in any case these are of only minor significance. The total present BOD discharge to the New River from these individual sources adds up to 11,210 lb/day. Direct measurements of the river waters show, however, that the total pollutional load actually carried by the New River at its mouth is much greater, amounting to 24,000 lb/day

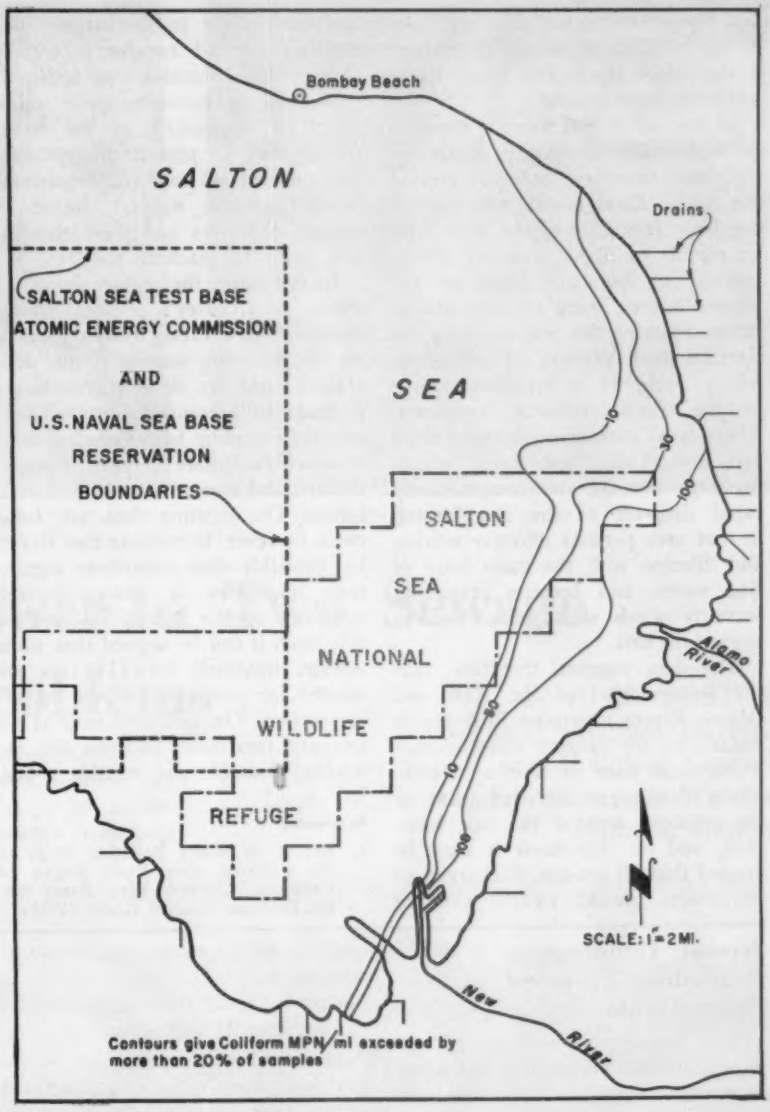



Fig. 6. SALTON SEA coliform densities.

in 1952. The difference can only be agricultural or natural sources, for example, decomposing plant matter in the drainage system.

Coliform bacteria in the New River, like the BOD, are derived from both sewage and agricultural and/or natural sources. There are high peaks of coliform densities below points of heavy sewage discharges, but these decrease rapidly downstream because of natural die-off. With respect to agricultural drainage, the coliform picture is confused, but the data do show that, although the tile drains which receive field percolation are not high in coliform counts, the ditches to which these drains discharge do build up high densities, in rough proportion to their length, and discharge of these ditches occurs all along the course of the river. Also, the coliform concentrations in the ditches are more or less in proportion to the accumulated flow volumes, indicating that the bulk of these coliforms are probably derived from agricultural or natural sources. The assembled data indicate that the New River at its mouth probably carries significant amounts of both sewage and non-sewage coliforms.

Both the bacterial and BOD load carried by the Alamo River are of lower magnitude than in the New River. Most of the sewage discharged to the Alamo River is treated. Also, the Alamo River drainage ditches appear to contain higher coliform densities than those of the New River,

and therefore it is probable that most of the coliform organisms discharged to the Salton Sea by the Alamo River are of non-sewage origin.

In the Salton Sea there is a region of high coliform density along the southeast shoreline, centered around the Alamo River mouth, and extending from just west of the New River mouth to about 4 miles southeasterly of Bombay Beach on the eastern shore. There are agricultural drains entering the Sea all along the contaminated portion of shoreline, which could be a principal source of the Sea's coliform organisms. There is no extensively contaminated area around the New River mouth, probably because the comparatively rapid drop-off of the Sea bottom in that area permits effective mixing and dilution with the main body of Sea water, and because prevailing westerly winds shift surface waters toward the east.

The data suggest, therefore, that the sewage load of the New and Alamo Rivers may pose little health hazard to the nearest water-contact recreational zone at Bombay Beach. These discharges are significant in the southern area of the Sea, however, and on this basis it may be argued that all sewage discharged to the rivers should receive primary treatment prior to discharge. Such treatment would remove potentially objectionable floatable and settleable solids and, by removing these solids, which if discharged to the rivers would tend to protect and prolong the survival of coliform organisms, would promote natural die-off of sewage coliforms and their elimination prior to reaching the Sea.

In summary, the picture as to the effects of Brawley's present sewage discharge in creating health hazards in the receiving waters is not conclusive, and to develop conclusive findings will require additional field surveys including bacteriological tests which differentiate between sewage-derived and non-sewage-derived coliforms. The existing data are sufficient, however, to indicate that Brawley probably does contribute significant quantities of sewage-derived coliforms to the Salton Sea and on this basis it can be argued that some sewage treatment facilities are needed for protection of the receiving waters. The indicated need is for primary treatment facilities for removing floatable and settable solids.

**References**


1. Report on Water Pollution Study of the Colorado Rive Basin Region of California. Colorado River Basin Water Pollution Control Board (1954).
2. Salton Sea Bacteriological Study. California Department of Public Health and Collaborators (April, 1958 and January, 1959) (Two reports).
3. Reports on the University of California Salton Sea Research Program (May 1954, May 1955, and May 1956) (Three reports).

4a. Requirements for the Control of Water Pollution and/or Nuisance in the New River. Colorado River Basin Water Pollution Control board (25 March 1955).

4b. Control of Water Pollution and/or Nuisance in the Alamo River. Colorado River Basin Water Pollution Control Board (23 September 1955).

4c. Control of Water Pollution and/or Nuisance in the Salton Sea. Colorado River Basin Water Pollution Control Board (10 February 1956).

5. Levine, Max, Henri Minette, and Ralph H. Tanimoto, "Characteristics and Expeditious Detection of Bacterial Indices of Pollution of Marine Bathing Beaches." Presented at International Conference on Waste Disposal in the Marine Environment, 22-25 July 1959, University of California, Berkeley.
6. Laws and Regulations Relating to Ocean Water-Contact Sports Areas. Excerpts from the California Health and Safety Code and the California Administrative Code. State Department of Public Health (1958).
7. Sewage Treatment and Disposal for the City of Brawley. Quinton Engineers, Ltd. (15 November 1948).
8. Colorado River Basin Regional Water Pollution Control Board:
   (a) Use and Quality of Alamo River Water (Supplement to Board action of 23 September 1955).
   (b) Use and Quality of New River Water (Supplement to Board action of 25 March 1955).


## Stream Temperature Regulation Proposed in Pennsylvania

Stream temperatures should be regulated because discharge of hot water to streams "may be against the public interest and may create difficulty in the future," the Sanitary Water Board of Pennsylvania was informed.

A special advisory committee to the Board, representing industry, sportsmen, and federal and state government, presented its report and recommendations to the Board, summarizing more than 20 months of detailed stream studies and conferences on problems posed by heated wastes.

The Health Department's environmental health bureau will study the committee's recommendations and then propose specific regulations for controlling stream temperatures for Sanitary Water Board approval.

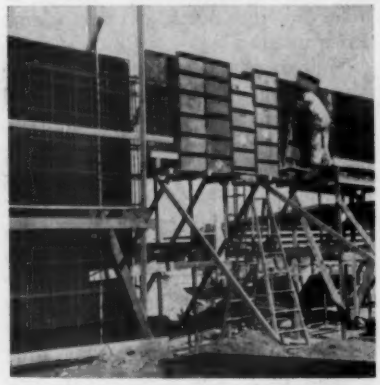
Dr. C. L. Wilbar, Jr., State Health Secretary and Sanitary Water Board Chairman, said that the effect of the committee's recommendations, if adopted, would be to require industries to keep their discharges from raising the total stream temperature to more than 93 degrees.

"Protection of aquatic life is the principal objective of regulating stream temperatures," the committee reported, adding that "there is no evidence that discharge of hot water to Pennsylvania streams has created a problem up to this time except in isolated and infrequent cases. However, such discharges may create difficulty in the future."

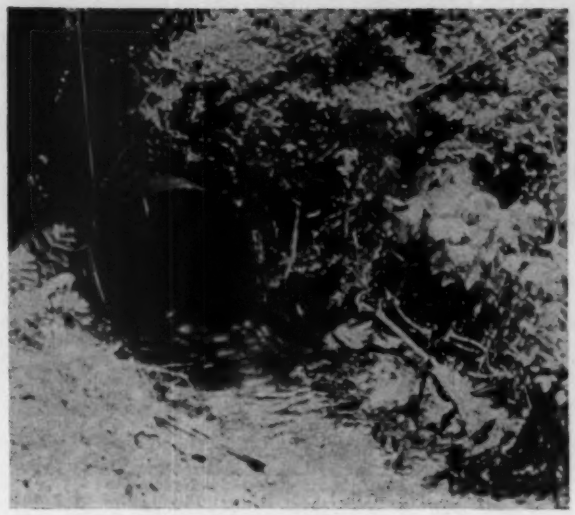
## Horizontal Gang Forming Methods Successful in California

Horizontal gang forming methods saved materials and time in the construction of two buildings in Norwalk, Calif. Decorative outside walls, requiring V-scoring at eight-foot intervals, were successfully poured with the use of pre-formed panels by contractor MacIsaac and Menke, Los Angeles.

The two almost identical buildings are for General Telephone of California and required 650 cubic yards of concrete for completion. The firm decided upon the gang forming method when they learned that the



walls could be successfully poured in much less time than would normally be required with standard methods. Symons Clamp and Manufacturing Co. Engineering Department worked on the problem prior to starting the job.



THE PROBLEM WAS THIS . . . . .

. . . . . AND THIS UNTIL . . . . .

# A Single Answer to Two Sewage Treatment Problems

by H. W. POSTON
Regional Program Director
Water Supply and Pollution Control
Dept. of Health, Education and Welfare
Chicago, Illinois

■ The communities of Westville and Belgium, Illinois, furnish an excellent example of how a solution can be found to what initially may appear to be an impossible financing problem for a sewage treatment

. . . . . THEY DECIDED TO CONSTRUCT THIS.

CONSTRUCTION PROGRESS of interceptor sewer.

VIEW OF CONSTRUCTION from influent end of plant.

project, especially for small communities whose bonded indebtedness may be restricted under State statutes.

The formation of a Sanitary District can often be the answer to financial problems such as this. The communities of Westville and Belgium formed the Westville-Belgium Sanitary District as a joint undertaking. Initial attempts by each town to find a solution to their sewage collection and treatment problems met with failure. One of the major reasons for this failure was the lack of financing capabilities.

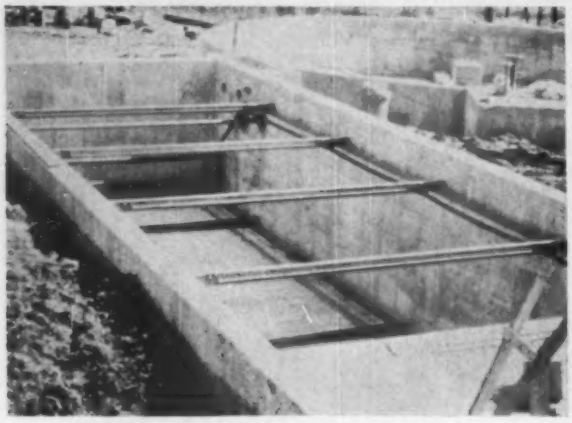
The financing problems appeared to be an insurmountable barrier until a group of progressive, and incidentally irate, citizens found an answer to the problem in the formation of a Sanitary District plus financial aid under the Federal Water Pollution Control Act. The obvious health hazard and the unbearable stench that permeated the communities during the hot summer months stimulated this "reform group" to forceful action. They took the lead in the formation of the Sanitary District and were elected to initial terms of office.

Mr. Tony Roman headed the District as president and among other members of the governing body was Dr. John Urbas who provided much of the initial impetus to the project. Dr. Urbas has provided excellent documentation to this phase of community history in the form of a pictorial record before and after the formation of the Sanitary District. His album of pictures is visual evidence of the benefits of this community improvement.

Not only has this project improved the community by eliminating untreated sewage from the natural drainage ditches and the adjacent stream, but almost immediate benefits were realized in the selection of the area as a site for a housing development. Prior to the advent of the community sewage treatment facilities, community development had been at a standstill because of the lack of these necessary sewage collection and disposal facilities.

The initial project undertaken by the sanitary district was in excess of a half a million dollars and consisted of secondary sewage treatment facilities and intercepting sewers which collect all of the dry weather sanitary sewage flow from the existing combined sewer system. The financial burden on this District of some 5,700 people was considerably relieved by a Federal grant of $167,545.87. In fact, the sanitary district officials were emphatic in their declaration that, "one of the things that put the project over was Federal participation." This is one vivid example of the stimulus provided by the construction grants program under the Federal Water Pollution Control Act.

This project was designed and constructed under the supervision of Clark, Daily and Deitz, consulting engineers of Urbana, Illinois.



VIEW OF PRIMARY settling tank.

VIEW OF digester construction.

## Guest Editorial

# A Cleaner Tomorrow For America's Water

by ABRAHAM RIBICOFF
Secretary of Health, Education, and Welfare

This will go down as a banner year in the long struggle to protect the Nation's water resources from unhealthy, costly, and destructive pollution.

With the passage and signing of the Federal Water Pollution Control Act Amendments of 1961, we now have the statutory basis to launch a new attack—on an unprecedented scale and on all fronts—against the mounting problem of water pollution.

The new law represents a major stride forward toward an objective in which the President is deeply interested.

In a speech in Pittsburgh last October, Mr. Kennedy said:

"The pollution of our water has reached the proportions of a national disgrace. It endangers our health. It limits our business opportunities. It destroys recreation."

His term as President was only a month old when he dispatched his "Natural Resources Message" to Congress, which stated:

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The President proposed "a more effective water-pollution control program." We now have the basis for such a program—one that fits the size and significance of the problem.

It is impossible to over-emphasize the importance to our country of this legislation. There is no need more basic than that of assuring our population an ample supply of usable water—and pollution is by far the major complicating factor in this continually enlarging problem. Control of water pollution is both a health—and an economic—imperative.

Water use is increasing enormously in the United States. Since 1900, while our population has tripled, our use of fresh water has jumped eight-fold—from 40 billion to 322 billion gallons a day. Agricultural, industrial, and recreational water use has increased enormously. By 1980, our total water needs will be 600 billion gallons a day—almost twice the present usage.

Obviously, municipalities and industries must increase their present rate of abating pollution. More than 100 million Americans get their drinking water from rivers carrying sewage, industrial wastes, and anything else that can be flushed down a sewer or thrown from a bridge. At the same time that municipalities and industries urgently need more clean water, they are unnecessarily fouling their own and others' water supplies.

We have not moved fast enough. We have not even been holding our own against the rising tide of pollution. Our efforts to control pollution must be geared to the growth rate of the forces which produce it—a swiftly increasing population and an expanding, urban, industrialized society.

With the introduction of water-carriage systems of sewage disposal in the 19th Century, dumping raw sewage into lakes and rivers soon became standard practice. In an earlier day, this was a fairly workable system. There was plenty of water; the wastes, being mainly organic, were subject to natural purification processes; and communities were neither as large nor as close to each other as they are today.

But as time went on, the volume of wastes not only increased but, with the rapid growth of industry, the wastes became more complex, more difficult to deal with in treating water for public consumption. Finally, after many unsuccessful starts, the "right" to pollute common water resources was effectively challenged and the principle of *waste* treatment—as well as *water* treatment—was established as a matter of Federal policy.

The Water Pollution Control Act of 1948 was the first comprehensive Federal legislation in this field. It provided the background for the Federal Water Pollution Control Act of 1956, which gave us, for the first time, effective measures to begin combating this grave problem. The 1956 Act greatly broadened and strengthened the earlier legislation by providing grants for the construction of municipal waste-treatment facilities, grants to improve and strengthen State and interstate programs, more workable Federal enforcement, and more effective research and fact-gathering. The 1948 and the 1956 legislation—each in its way—represented a defi-

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CONSTRUCTION PROGRESS of interceptor sewer.

VIEW OF CONSTRUCTION from influent end of plant.

project, especially for small communities whose bonded indebtedness may be restricted under State statutes.

The formation of a Sanitary District can often be the answer to financial problems such as this. The communities of Westville and Belgium formed the Westville-Belgium Sanitary District as a joint undertaking. Initial attempts by each town to find a solution to their sewage collection and treatment problems met with failure. One of the major reasons for this failure was the lack of financing capabilities.

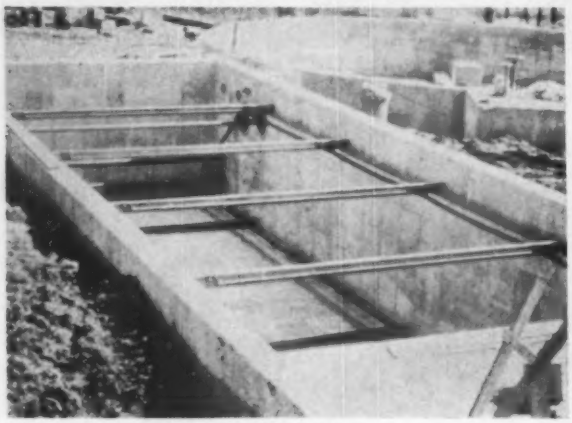
The financing problems appeared to be an insurmountable barrier until a group of progressive, and incidentally irate, citizens found an answer to the problem in the formation of a Sanitary District plus financial aid under the Federal Water Pollution Control Act. The obvious health hazard and the unbearable stench that permeated the communities during the hot summer months stimulated this "reform group" to forceful action. They took the lead in the formation of the Sanitary District and were elected to initial terms of office.

Mr. Tony Roman headed the District as president and among other members of the governing body was Dr. John Urbas who provided much of the initial impetus to the project. Dr. Urbas has provided excellent documentation to this phase of community history in the form of a pictorial record before and after the formation of the Sanitary District. His album of pictures is visual evidence of the benefits of this community improvement.

Not only has this project improved the community by eliminating untreated sewage from the natural drainage ditches and the adjacent stream, but almost immediate benefits were realized in the selection of the area as a site for a housing development. Prior to the advent of the community sewage treatment facilities, community development had been at a standstill because of the lack of these necessary sewage collection and disposal facilities.

The initial project undertaken by the sanitary district was in excess of a half a million dollars and consisted of secondary sewage treatment facilities and intercepting sewers which collect all of the dry weather sanitary sewage flow from the existing combined sewer system. The financial burden on this District of some 5,700 people was considerably relieved by a Federal grant of $167,545.87. In fact, the sanitary district officials were emphatic in their declaration that, "one of the things that put the project over was Federal participation." This is one vivid example of the stimulus provided by the construction grants program under the Federal Water Pollution Control Act.

This project was designed and constructed under the supervision of Clark, Daily and Deitz, consulting engineers of Urbana, Illinois.



VIEW OF PRIMARY settling tank.

VIEW OF digester construction.

## Guest Editorial

# A Cleaner Tomorrow For America's Water

by ABRAHAM RIBICOFF
Secretary of Health, Education, and Welfare

This will go down as a banner year in the long struggle to protect the Nation's water resources from unhealthy, costly, and destructive pollution.

With the passage and signing of the Federal Water Pollution Control Act Amendments of 1961, we now have the statutory basis to launch a new attack—on an unprecedented scale and on all fronts—against the mounting problem of water pollution.

The new law represents a major stride forward toward an objective in which the President is deeply interested.

In a speech in Pittsburgh last October, Mr. Kennedy said:

"The pollution of our water has reached the proportions of a national disgrace. It endangers our health. It limits our business opportunities. It destroys recreation."

His term as President was only a month old when he dispatched his "Natural Resources Message" to Congress, which stated:

"Our Nation has been blessed with a bountiful supply of water; but it is not a blessing we can regard with complacency. . . Our available water supply must be used to give maximum benefits for all purposes—hydroelectric power, irrigation and reclamation, navigation, recreation, health, home, and industry . . . . To meet all needs—domestic, agricultural, industrial, recreational—we shall have to use and reuse the same water, maintaining quality as well as quantity. In many areas of the country we need new sources of supply—but in all areas we must protect the supplies we have."

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# Water Utility Distribution Loss
# Part 1

EDITOR'S NOTE: This first installment of a series on water quantity accounting outlines the problem, discusses the utility system generally and the utility distribution system specifically. Predicated on complete metering and systematized accounting, the method is adaptable to machine accounting procedures. Staggering national distribution system loss, estimated at $50 million per year for operating costs alone, is well worth studying and correcting.

by DALE SMELSER
Knoxville, Tennessee

■ EVERY PERSON is vitally concerned with water. Like the air one breathes, it is essential to life. In keeping with the high standard of living enjoyed in this land, the demand for an increasing supply of water for necessary and luxury purposes has been pronounced over the past two decades.

Water, as air, is a product of nature and basically is free for the taking; however, in the development of the community and industrial life in this country, many sources of water have been loaded with extraneous matter which must be removed to render it suitable for use. The average service area to be supplied is far removed from the source, hence the necessity for the "delivery" function. The water supply industry is dedicated to the problem of gathering, treating, and the delivery of this product. As in other lines of endeavor this requires expense, the amount of which is determined by several conditions, such as the source as found, the requirements of the area to be serviced, and its distance from the source.

A water utility may be defined as a monopoly, affecting the public interest[1]. It may be publicly or privately owned and operated with the common objective of providing the area served with an indispensable commodity. The average water utility system consists of:

1. Collecting facilities for gathering the raw water as found and delivering it to the treatment plant.
2. Purification plant for treating the raw water to remove all foreign matter, and prepare it to meet the required standards for quality and in sufficient quantity.
3. Transportation or distribution system for "delivery" of the finished product to the consumer, with special attention to the control of losses during the "delivery" function.

The complete water works system must be so designed, constructed, and operated to produce and deliver to an exacting public a product that is esthetically acceptable as well as satisfying the requirements of the domestic, commercial, and industrial customers. As with every productive effort, the practice of economy should be diligently pursued in all branches of the business. Unlike other industry a water supply must be tailored to fit the needs of the particular area to be served. This requires an intelligent study of prevailing conditions, including: the condition of the raw water as found; the relative elevation of the plant to the source and to the service area; the size of the area to be served, and the quantity to be used by the several consumer classifications. The future needs should be forecast by a study of population trends and the per capita requirements of the several classifications. (See Table No. 1.).

### The Need for Loss Control

Loss and waste prevail in many operations both large and small. We are here concerned with an operation serving a metropolitan area of approximately 100,000 population, and where all consumer accounts are metered. The study is directed to an analysis of the contributing factors to water losses in the delivery or distribution system of the water utility. While much attention has been given to this problem through the years, the control of water loss is possibly of greater importance today than ever before. The continual growth in population during an era of vast economic and social changes has imposed an increasing demand on water systems. The application of loss reduction or preventive measures will have a far-reaching beneficial effect on the industry. It will increase the revenue and

**Table 1**

**Total Water Consumption Per Capita For Metered System**

| Use | Gallons Per Capita, Per Day | | |
|---|---|---|---|
| | Minimum | Maximum | Average |
| Domestic | 20 | 100 | 50 |
| Commercial and Industrial | 10 | 130 | 35 |
| Public | 2 | 20 | 5 |
| Loss | 7 | 40 | 20 |
| Total | 39 | 290 | 110 |

From: American Water Works Association, "A Survey of Operating Data for Water Works 1955," JAWWA 49:555 (1957).

improve the service. It will permit full utilization of existing facilities, and in some cases postpone the necessity for capital expenditures to provide additional plant. The water supply industry is almost as old as the country itself, yet the preventable losses prevailing in the industry as a whole are astoundingly large.

"Probably in no other industry is there so much room for improvement in operating efficiency as in the water industry, and particularly in the small town municipal water plant. The loss of water from the distribution system represents a needless waste of chemicals, electric power, and labor that adds nothing to economic growth. Profitable operation of a water system is directly related to water loss and input efficiency. Correctable loss in this country has been estimated at $50,000,000 per year."[2]

A report entitled, "Revenue Producing Water" was presented on May 13, 1957, at the AWWA annual conference in St. Louis, Mo., by Mr. E. Shaw Cole, Chairman of the Committee that compiled the report. This is a very interesting and timely message, and is in part quoted as follows:

"The increase in demand for water due to improved living standards, population growth, and industrial expansion is rapidly approaching the limit of the great natural resources. Most communities are finding it increasingly difficult and expensive to enlarge their sources of supply and plant facilities, so that the incentive to conserve their existing supply is greater than ever.

The cost of an additional supply is frequently more expensive than the original construction because of the need to go a greater distance from the community or to develop a new source which has less yield per invested dollar or simply because of inflation. Ground water is being depleted, and water tables are being lowered. The least expensive supplies were developed initially; but even without considering the steady rise in construction costs, future supplies will be almost certain to cost more than the existing ones.

Conservation is, therefore, a fundamental part of water works operation in an established community, due to the direct money savings in operation and the longer range savings from deferred capital costs for plant expansion.

Direct savings can be made in the cost of production by reducing the amount of chemicals or power consumed, or, if the water supply is purchased, the saving is in dollars paid to the wholesaler. Deferment of the need for plant expansion saves capital expenditures, and is thus another type of saving."[3]

Both in this country and Great Britain the subject has been discussed for at least eighty years. The first meeting of the AWWA was concerned with loss, and the initial issue of the Journal in 1881 contained an article on water losses. In 1882 George F. Deacon of the British Institute of Civil Engineers appeared before the Society of Arts with a paper, "The Constant Supply and Waste of Water." During recent years the British Institute of Water Engineers has been actively engaged in the study and prevention of water losses. A committee of the Institute developed a leak-detection device capable of operation regardless of extraneous noises or adverse weather conditions.[4]

The present day need for efficient operation of water plants in this country is indisputable. It is common knowledge that in some sections of the country an actual shortage of water exists; which certainly points to the wisdom of applying methods to secure full utilization of available supplies and facilities. It is generally agreed that each consuming unit added to a system tends to decrease the unit cost of production. This will continue until the installed capacity of the facilities is reached. The great concern of a given operation is when the capacity is approaching full utilization. It is at this point that additional facilities must be considered, and it must also be decided whether to provide for the short or long term outlook. The existing plant is usually assumed as the datum for the short term, while the long term view assumes that the larger the installation, the less the unit production cost would be, assuming full utilization of capacity. The question is, therefore, how much of this over expansion or under utilization of capacity can be borne by the present customers.

As a metropolitan area expands, the settled area grows larger, generally at all points of the perimeter of the service area. Each new service connection changes the decreasing cost "status-quo" for a given system as to capital investment, and the location and nature of

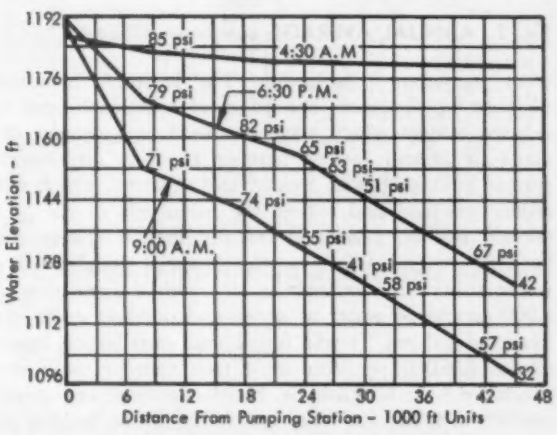



**Fig. 1. HYDRAULIC GRADIENTS of distribution system. (From W. D. Hudson, "Flow Tests on Distribution Systems,") AWWA 46:149 (1954).**

demand on the system. With suburban living, shopping centers, better highways, the decay of down town areas, the dispersement of industry, and perimeter expansion; the water must be transported and distributed over an increasing distance. This increases the friction loss in the existing pipe lines, which in turn will require additional pumping head. The spectacular growth of "fringe-areas" tends to move the load centers further from the production facilities. Due to the added distance to the load center, the pumping pressure must be raised, and all this added quantity of water, with additional pressure, must be forced through the older pipe in the system. The result is invariably an increase in leakage from pipe joints. In recent years many water systems have taken the hazardous risk of substantially raising the pumping pressure in an effort to satisfy a demand in the system, possibly distant from the source. Such an effort is too often followed by disastrous pipe breaks and an accelerated rate of leakage

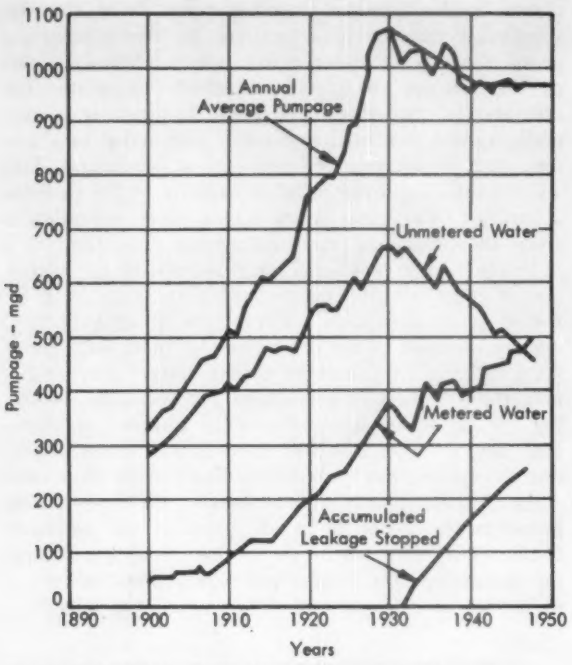



**Fig. 2. ANNUAL AVERAGE pumpage—Chicago[3].**

from numerous pipe joints. The hydraulic gradient (Figure 1) illustrates the effect of additional head in a given system which may be caused by customer demand or system loss. Wherever possible, distribution system leaks should be located and repaired, which will reduce the load and extend the useful life of the production facility. Losses in the distribution system can have an adverse effect on the financial stability of a water utility. For example, a city with a population of 8,000 purchased water at seven and one-half cents per thousand gallons. It was found that distribution losses totaled $26,000 per year or 47 per cent of the water purchased.[2] At Greensboro, North Carolina, one three-quarter inch service pipe was found to be leaking at a rate of 25,000 gals. per day.

This study is concerned primarily with waste and loss in the distribution system. A complete distribution system for a water utility includes all the facilities required to receive the water from the pumping station or reservoir, and deliver it to and through the meter serving the customer. Such facilities will include all transmission and distribution pipe lines with the necessary valves, fire hydrants, ground storage tanks, reservoirs, elevated tanks, stand-pipes, booster pumps, service pipe and meters. Each one of the component parts is a potential source of loss by leakage. Leakage may be divided into two classes, namely: Allowable or unavoidable seepage or leakage and correctable leakage. It has been estimated that correctable leakage for the 13,000 public water systems serving 85,000,000 people amounts to 4,000 millions gallons per day. This loss of water results from hidden leaks or breaks, which in the absence of a survey can continue undetected for years. An analysis of losses stopped in cities of various sizes is contained in Table 2. It is interesting to note in this analysis that live service leaks accounts for a considerable percentage of the losses. Such leaks can usually be discovered by applying a listening device to the service pipe in the meter pit, after closing all outlets on the consumer's premises. This is a relatively simple procedure, and the benefit that may be derived certainly denotes its practical value. An operation of any size can ill-afford not to devote time to searching for leaks and especially so if the unaccounted for water is a high percentage of the water delivered to the system. A truly remarkable accomplishment was carried out in Chicago from 1930 through 1945, as reported by Justus B. Eddy[5] Engineer with the Chicago Water Department. Figures 2 and 3 illustrate graphically the

**Table 2**

**Analysis of Losses Stopped in Cities of Various Sizes**

| Type of Loss | Population Served 4,000 (Per Cent) | 9,000 (Per Cent) | 50,000 (Per Cent) | 2,000,000 (Per Cent) | 4,000,000 (Per Cent) | 7,000,000 (Per Cent) |
|---|---|---|---|---|---|---|
| Live service leaks | 93 | 75 | 34 | 18.0 | 51.0 | 42.5 |
| Dead service leaks | 3 | 21 | | 23.0 | | 3.5 |
| Fire hydrant leaks | 2 | 3 | | | 2.5 | |
| Lead joint leaks | 2 | 1 | | 10.0 | 33.0 | 34.2 |
| Main leaks | | | 5 | 28.0 | 5.0 | 15.9 |
| Miscellaneous leaks | | | | 1.5 | 7.0 | |
| Slow meters | | | 61 | 16.5 | | |
| Unauthorized use | | | | 3.0 | | |
| Inside plumbing | | | | | | 3.9 |
| Valves | | | | | 1.5 | |

From: D. W. Johnson, "Losses in Distribution Systems", JAWWA 39: 164 (1947).

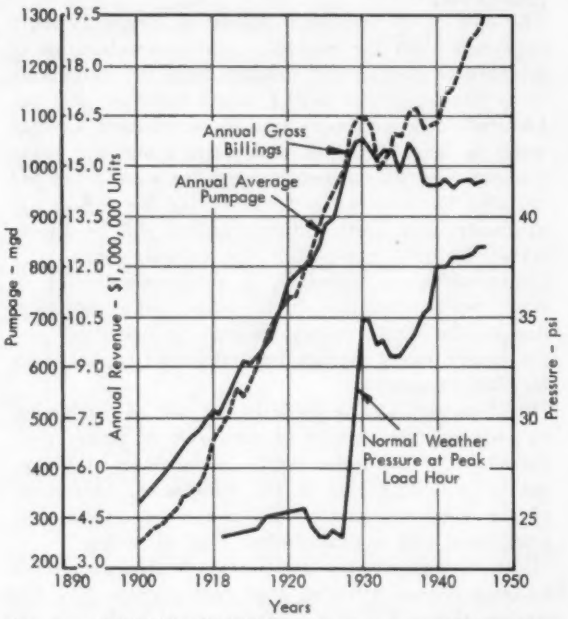



**Fig. 3. ANNUAL REVENUE and pressure—Chicago[3].**

results of this outstanding program, which shows an increase in the annual gross billings, while at the same time the annual average pumpage was decreasing.

The achievements of the second largest city in the nation may be summarized as follows:

1. Lower daily average pumpage with higher delivery pressure.
2. Lower cost of operation through a savings in coal and power cost. Extended life of pumps, boilers. and motors. Lower cost of maintenance.

3. Lower maximum hour demand with greater improved delivery pressure at high hour.
4. Postponement of plant construction.
5. Meeting of all requirements for water during World War II without increasing the water supply plant.[5]

### Manufacturing Losses

Any product that is manufactured and used in our modern society has associated with it certain inherent losses, which may be divided into three classes as follows: 1. Losses in the manufacturing process. 2. Losses in the distributing process. 3. Losses associated with customer utilization.

In a water utility the losses that occur in the production or manufacturing stage will vary from plant to plant, also will vary in a given plant as the character of the raw water changes, which in turn determines the extent of treatment needed. In a typical surface water treatment plant about 105 per cent of raw water will be required to produce 100 per cent of finished water. Figure 4 shows a water quantity flow diagram of a surface water treatment plant at Knoxville, Tenn. Under plant uses are listed the several elements in the process that require the use of water, namely: samples for testing, drains and blow downs for basins, filter back-washing, pump glands, and sanitary uses. The gains are shown as the water added to basins by rain or snow. The losses include the evaporation from open basins and leaks from piping and basins. The water used to dilute chemicals is, of course, returned to the process. For the month of Jan., 1959, the plant uses at Knoxville was 22.362 mg, which is 3.67 per cent of the high lift pumpage.

Of course, the water used for processing in the treatment plant cannot be classified as a loss, but rather as necessary to accomplish the treatment process. In a properly operated treatment plant attention is given to the quantity of water used in the process and the amount is held to a minimum consistent with maintaining the product at a high standard of quality.

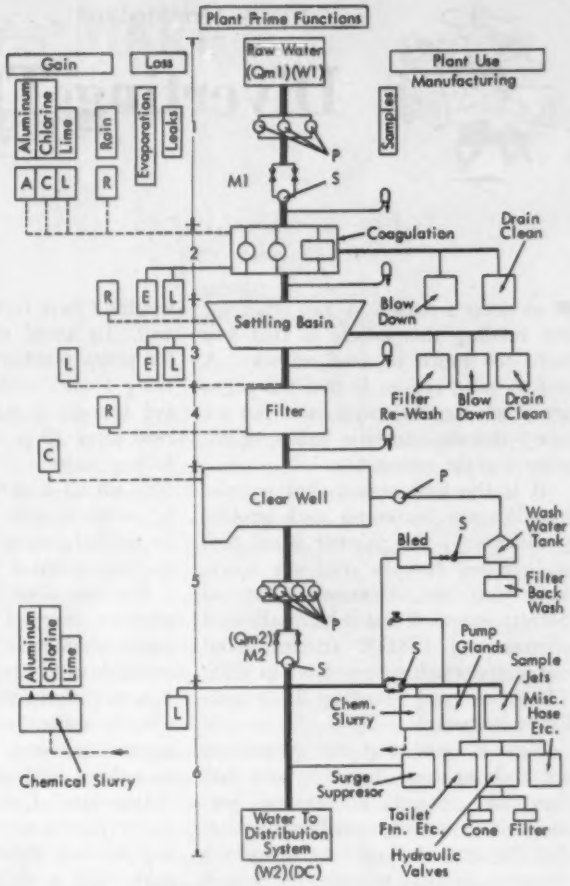



**Fig. 4. WATER QUANTITY flow sheet for water treatment plant.**


#### References

1. Trachsel, H. H., "Public Utility Regulation," First Edition 1947, 7, Richard D. Irwin, Inc., Chicago, Ill.
2. Johnson, D. W., "Losses in Distribution Systems," JAWWA, **39**:158 (1947).
3. Cole, E. S., "Revenue-producing Water Versus Unaccounted-for Water," Committee 4450 D. JAWWA, **49**:1587 (1957).
4. Committee "J" Leak Detection, Journal, Institution of Water Engineers, **3**:342 (1949).
5. Eddy, J. B., "Underground Leakage Work in Chicago," JAWWA, **39**:713 (1947).


## Preboring for Piles has Advantages

Intercounty Construction Co., Hyattsville, Md., is putting in 1400 feet of 11-ft diameter concrete storm sewer under Benning Road in Washington, D.C.

The pipe is laid in a monolithic pour 22 feet below grade. A backhoe and clamshell are used to open up the ditch, the latter especially when underground utility connections get in the way.

The company uses a preboring method which consists of dropping H-beam piles into holes augered out by a Ka-Mo A-295 earth boring machine to put in the shoring without resorting to pile driving and its attendant noise, heavy equipment, and allowance for working space.

After breaking through the concrete road surfacing, the firm moves in a truck crane with the 18 hp Ka-Mo unit mounted on the boom.

This unit bores a 16-in. diameter hole down anywhere from 20 to 28 feet on both sides of the ditch to be opened, spaced at regular intervals along the way.

H-beams are dropped into the holes and, as excavation progresses downward, wood shoring is dropped lengthwise along the excavation in between the slots formed by the series of H-beams. Bracing is inserted crosswise as the ditch is deepened.

The preboring method results in these advantages over driving pile: much less noise, lower investment in machinery, fewer delays due to manuverability, and faster placement of H-beams in the ground.

Partially Oriented on . . .

# Diverting The Deluge

■ AS GOOD a reason as any other for not reading this article is that you have too much to read anyway. A not so valid reason is that the pages are stuck together with jam, but we won't discuss domestic habits of engineers at the moment.

It is the first reason that worries me. We are becoming such prolific producers of the printed word that no one has time to read any more. Last year the American Chemical Society reported that it had published abstracts of 128,000 articles about chemistry which were printed in 1959. (They are still counting those published last year).

Now I know that the Americans are a clever race of people, and that they have recently nurtured a Senator whose reading speed was so fast that he got through the Pilgrim's Progress in 19½ minutes—or was it 17½ minutes—I can't quite remember as I read the article so fast. But over here, in the sticky mud of the English countryside, I feel such a fuddy duddy old square of an engineer that I don't know what to make of this information. I don't know whether to laugh or cry, or go to bed for a week and try and forget it.

If 128,000 chemical articles get written by X number of chemical authors, where X must surely be less than 128,000 (or is America *that* big!) - then when do these busy people get time to read the stuff they have written? Is there anybody . . . . . "High and clear I shoot my voice over the waves, Surely you must know . . . . ." - is there any one person of a technical calling who reads *all* the printed professional matter that gets sent to him?

To save you the cost of postage stamps, I will now give you an answer to this question myself - no, there is not. If anyone tried to read all of his professional literature, he would so quickly find it necessary to take his head to a repair shop that he wouldn't have time to make a sensible will. To avoid this disaster I have for years practised not reading anything I can't understand. The standard I apply is that anything I can't read after 10 p. m. at night without falling asleep I don't read. This cuts out all $\Sigma$ and $\int$ stuff immediately, which is just as well as I would be unlikely to understand that kind of thing when I was awake anyway.

But this does not solve the whole problem. Since I don't know in advance whether anything will turn out readable until I try it out after 10 p.m. I have to keep this literature around me for quite some time. It would appear to be a professional sin - something against something in the Professional Code of Conduct - to throw papers away without attempting to read them. So they get 'put aside' for a dull day, or when I might find myself in bed with influenza - excepting I have never yet felt well enough in bed with influenza to read anything but the thermometer.

'Putting aside' technical literature is one of those fancy phrases which bears no relationship to the actual course of events, (like 'making a closed traverse' through a thicket of gorse bushes). These lumps of highly compressed and wire-stitched-together printed matter are not so easily set aside. I have piled them high on my desk hoping that the safe angle of repose might in due course be exceeded and good number might slide off into the wastepaper basket without me noticing - but someone is sure to come along and pick them out again for me.

I have lined bookshelves with them, and the bookshelves now look like redundant frames undergoing a severe attack of sway and bending moment. I have propped up my drawing board with them, put them in a corner of the room under some brick samples; I have taken them home and brought them back again out of consideration for the needs of a growing family; I have fallen over them, lent them - I have done everything a man of sound physical health could be expected to do just short of the final wickedness of burning them, but the rate of loss, dismemberment, decline, or delapidation of these printed bricks has been so infinitely small compared with the monthly rate of inflow, that it seems there is no chance of solving the problem unless I go and live near a disused coal mine.

The greatly decreased mobility of engineers over the age of 45 years is generally thought to be something to do with their superannuation rights: but it is not so. It is simply that after twenty-five years'membership of our professional institutions few men can afford to contemplate the cost of moving their belongings with them. To find and be employed by a Firm With A Basement, is an advantage that few engineers are willing to give up. To leave - to leave just like that, without a backward glance as to what one is leaving behind one, is to become an outcast in the profession, to be dubbed by one's former colleagues as "that bounder who left all his stuff behind him; what on earth shall we do with it?" No gentleman engineer could behave like that.

Of course for the Americans it is not so bad. They are so far ahead of the rest of us that they have been building tall buildings for years. As we know from the cinema, nothing ever happens in a skyscraper below about the 17th story, and nothing could either, because each lower story is full of thousands upon thousands of journals, transactions, proceedings, and papers and abstracts all stored away by worried engineers and chemists who mean to get around to doing some reading one day. Which reminds me that it is nearly 10 o'clock and I haven't looked at today's comics.

# The Water Companies Make Public Utility Law Again*

by CHARLES A. BANE
Attorney, Isham
Lincoln & Beale
Chicago, Illinois

■ IT IS REMARKABLE, upon reviewing the course of public utility decisions in this country, to find how often basic principles of utility law have been established by our highest courts in proceedings involving water companies. Concentrating only upon the Supreme Court of the United States, and for the period from 1920 to date, there is a striking record of important decisions on basic principles of utility law in water utility cases. The *Ben Avon* opinion (*Ohio Valley Water Company* v. *Ben Avon Borough*, 253 U.S. 287, decided in 1920) considered that a court must exercise its important judgment on both law and facts in utility decisions, although a previous decision, again involving a water company (*Knoxville* v. *Knoxville Water Company*, 212 U.S. 1) had tended to the conclusion that a reviewing court, rather than exercising its independent judgment, should regard regulatory determinations as *prima facie* valid and proper. Another important decision, in setting forth standards for fair rate of return, and stressing the importance of the capital attraction test, is the *Bluefield* case (*Bluefield Water Works and Improvement Company* v. *Public Service Company of West Virginia*, 262 U.S. 679). Consideration was given to the extent to which reproduction cost testimony had to be received and considered in the leading case of *McCardle* v. *Indianapolis Water Company* (272 U.S. 400).

### Rate Increase Litigation

In recent months the Supreme Court of Illinois has had occasion to render a wide-ranging decision on a number of important modern day questions of public utility law, in the *City of Alton* v. *Illinois Commerce Commission and Alton Water Company* (19 Ill. 2d 76, 165 N.E. 2d 513). Since the Alton Water Company has not yet achieved finality in its rate structure, it is doubtful that the Company feels any satisfaction that its problems have brought about a court decision of such consequence, but it has nevertheless done so.

The appeal decided by the Supreme Court of Illinois was an outgrowth of a general rate increase proposed by the Alton Company to the Illinois Commerce Commission with a rate schedule filing made in February, 1957. Three years were required for the disposition of the matter by the Supreme Court of Illinois; and even that was not the end of it, since the decision called for a remand of the matter to the Commission for further consideration on certain points discussed by the Court.

The opinion was a wide-ranging one by reason of the number of points that had been raised, some outside the record, by the intervening municipalities and customers. Perhaps one matter in the decision was more important than the others, and represented a facing up by the Court to a most difficult question, with a decision in favor of the public utility. In response to protests by the intervenors that fair value rate-making resulted in unconscionably large returns to the common equity, particularly when that equity is a thin portion of the capitalization, the Court responded that comparisons were not to be made with respect to the return on the book or investment value or cost of the Company equity, but rather on that equity's fair or present value. The Court suggested a number of ways in which the computation of such value might be made:

"The approach taken by the circuit court assumes correctly that the return to each class of security holder is relevant in judging whether a given overall rate of return is reasonable. Due to the relatively low cost of debt financing, an overall rate of return of 5.6 per cent might yield a return to common stockholders of 6 or 7 per cent in a utility with little debt but yield a much higher return to common shareholders of a highly leveraged utility with a high percentage of debt in its capital structure. Neither the Commission nor the courts may ignore this fact. The circuit court also assumed, however, that return on the original common stock investment was the relevant figure in determining the reasonableness of an overall rate of return. In this assumption the court erred. It is well established in Illinois that the utility is entitled to a reasonable overall return on the fair value of its property, not the original cost. This provides a flexible rate-making standard which is equally applicable in periods of rising and falling price levels. (See *City of Chicago* v. *Illinois Commerce Com.*, 4 Ill. 2d 554) It would be inconsistent to judge the overall return on the basis of fair value but judge the return accruing to common shareholders on the basis of a par value which is essentially original cost. The significant figure is the rate of return on common stock valued at fair value.

"Several methods of computing this figure might be used. Either actual debt costs or hypothetical debt costs based on the current market might be subtracted from revenue after operating costs to produce net income allocable to equity. The fair value attributable to common stock might be determined by subtracting the par value of debt and preferred stock, to reflect the fact that all increments in value belong to equity, or by dividing fair value in the same percentages as book value. The sizeable short term debt may be considered entirely as debt or its temporary nature might be recognized by allocating

*Paper prepared for the Eastern Water Company Conference, Atlantic City, New Jersey, October 18, 1960

part to debt and part to equity. Whatever method is chosen as most appropriate in this case the return on the fair value attributable to common stock fails within the range of the testimony."

This is a most important point to have been decided, since hardly a rate case proceeds, for any type of utility, in a fair value state, without comparison being made to suggest an excessive or even outrageous return on the equity by reason of the rate increases which are proposed. It is, of course, inevitable in a fair value state that the return on the equity can be computed as being high in terms of percentages of return on book value, and if such return is computed after taking account in the operating revenues of only the historic cost of debt and preferred stock. In some instances there have even been assertions by those opposing rate increases that the value of the property found as fair value, to the extent that it exceeds original cost, likewise constitutes a kind of return to the equity and should be taken account of as such. Such a suggestion is made without regard to the fact, of course, that the property is never distributed to the equity holders or the fair value realized upon by them except through the medium of return on rates based upon fair value. With this background, it therefore seems clear that the Supreme Court of Illinois has enunciated an important principle and one of great benefit to utilities in fair value states, by realistically concluding that any return to the equity is to be computed only after a fair value has been determined or computed for the equity.

### Deferred Federal Income Tax Benefits

In a number of other respects the Court upheld the utility's position. After an initial opinion in which the Court disapproved of the Commission's recognition as an operating expense of deferred Federal income taxes arising from accelerated depreciation, the Court on rehearing revised its opinion to permit recognition of such an item, although only upon condition that amounts accumulated as a result of such deferral, whether in a reserve or otherwise, shall be deducted from the rate base. Of course there are almost as many opinions on the matter of proper treatment of deferred Federal income taxes as there are regulatory authorities or courts which have been called upon to decide the issue, but certainly it would be difficult to conclude that the Supreme Court of Illinois was not sensible in its view that some benefit from deferred Federal income taxes ought to be passed along to present consumers. On this premise, the court would seem to have been reasonable in its conclusion that one way to pass along such benefit to consumers is to deduct from the rate base the cumulative amounts of deferred Federal income taxes. Another alternative would be that of taking account of such deferred federal income taxes in arriving at the appropriate rate of return, on the theory that deferred federal income taxes in effect represented debt money which was available without the payment of interest. This latter solution did not commend itself to the Supreme Court of Illinois.

### Court Approves Depreciation Computation

In another area, the Court further ruled in the Water Company's favor in approving an observation method of computing depreciation on reproduction cost, as against contentions that a straight-line method ought to be used. The Court rejected a suggestion that the observation method might not be reliable since much of a water company's property is located underground.

In its discussion of this subject, the Court rendered a real service. It reminded that the straight-line method of computing depreciation constitutes only an accounting technique for allocating the cost of fixed assets over the life of the assets and is not a measure of the actual depreciation taking place in the property. The methods that won the Court's approval and its view on the subject of the unacceptability of the straight-line method for determining actual accrued depreciation are set forth in the following excerpt from the Court's opinion:

"The Company's witness, Howson, testified that depreciation of 15 per cent should be deducted from the reproduction cost of the Company's plant. The Commission's witness, Cavanagh, testified to depreciation of 26 per cent, and the Commission found 25 per cent depreciation. Howson relied primarily on inspection for his determination of depreciation, supported by calculations on a 4 per cent sinking fund basis. Cavanagh also inspected all of the Company's above-ground facilities and examined pertinent records, but depended to a greater extent on 3 per cent sinking fund computations. The circuit court felt that the observation method employed by these two witnesses was not reliable since 40 per cent of the Company's plant consists of pipes and mains located beneath the ground and not subject to inspection. Evidence of subnormal service to many customers, coupled with straight-line computations indicating a depreciation figure of 37 per cent, convinced the court that the Commission's determination was erroneous.

"Although the straight-line method of computing depreciation is widely accepted, it is only an accounting technique for allocating the cost of fixed assets over the life of the assets. It is not a measure of the actual deterioration of property. (*United Railway & Electric Co. of Baltimore* v. *West* 280 U.S. 234, 262, 74 L. ed. 390 (1930).) For rate proceedings in which fair value is a controlling factor, a determination of depreciation by inspection may be preferable to accounting computations, and certainly is an acceptable method. (See *McCardle* v. *Indianapolis Water Co.* 272 U.S. 400, 71 L. ed. 316 (1926); *Pacific Gas & Electric Co.* v. *City and County of San Francisco*, 265 U.S. 403, 68 L. Ed. 1075 (1924). Therefore, the circuit court's straight-line computations indicating a depreciation figure of 37 per cent do not alone undermine the result reached by the Commission by other methods. Nor was the inspection defective because a large part of the Company's plant is located beneath the ground. Howson tested this portion of the plant by an examination of 95 out of a total of 200 cuts taken from the underground pipes and mains. Cavanagh checked the Company's figures by examination of the Company's records of installation and maintenance and through the use of age-life tables. The methods

employed by these two witnesses seem reasonable and the Commission committed no error in basing its determination on their results."

### Depreciation Accrual

In its consideration of accrued depreciation the Court likewise took account of a suggestion that accrued depreciation ought to be increased to take account of alleged service deficiencies. The Court spoke as follows, in rejecting this view:

"There was testimony that the Water Company's service to domestic customers and for municipal fire protection was deficient in many respects. This might well indicate that physical depreciation had in fact proceded beyond the extent indicated by inspection. In holding the Commission's determination of depreciation erroneous, the circuit court considered this 'appraisal by function' as 'perhaps more convincing' than appraisal of depreciation by observation. The Commission, on the other hand, dealt with the problem of substandard service not by adjusting depreciation but by a direct order requiring the Company to submit, within 60 days, plans for improving service.

"We cannot agree that the Commission's approach was erroneous. Both supervision of service and supervision of rates are functions of regulatory commissions. In several jurisdictions, it has been held that these functions must be kept distinct so that a rate increase may not be conditioned upon the utility's compliance with an order to improve service. (E.g., *Florida Telephone Corp.* v. *Carter*, 70 So. 2d 508 (Fla Sup. Ct. (1954)); *Elyria Telephone Co.* v *Public Utilities Com.* 158 Ohio St. 441, 110 N.E. 2d 59 (1953).) And in another state it was held error for a Commission to decrease the rate of return because of substandard service, on the ground that this action would prevent the utility from acquiring the capital necessary to improve its service. (*Petitions of New England Telephone and Telegraph Co.* 116 Vt. 480, 80 A. 2d 671 (1951). In this case it is not necessary to decide these broad issues of the Commission's authority and power. We hold only that it was permissible and reasonable for the Commission to deal with deficient service in a separate order rather than by adjustments to depreciation. (*See Village of Apple River* v. *Illinois Commerce Com.* No. 35319.)

### Overhead Expense Allowance

In several areas the Court ruled against the utility's contentions. It suggested that a 15 per cent allowance on reproduction cost for overheads might be too high. The problem here arose in part by reason of an expression of opinion by counsel for the Commission that a 15 per cent allowance was higher than any other that he knew of. It later developed that he was thinking of an allowance for overheads which did not include interest, but in any event, the Court concluded that the Commission ought to take another look at the matter, since the case was being referred to the Commission on other grounds. An interesting observation of the Court in connection with overheads (which were considered to be organization expense, engineering and supervision during design and construction, administrative and legal costs, omissions and contingencies and interest lost on non-productive investment during construction) was to the effect that an unusually high percentage for overhead expenses can not be justified in terms of generally rising costs, because any such high level of costs is already reflected in the basic reproduction cost of which the overheads constitute a percentage.

### Offsetting Tax Accruals

In the area of working capital, the court decided that tax accruals ought to be offset against capital working requirements even to the extent of the materials and supplies component of working capital.

Whatever may be the views as to the propriety of offsetting tax accruals (i.e., funds collected on account of Federal income taxes, property taxes or other taxes in advance of the required payment dates) against cash working capital requirements, it would seem erroneous to state that such accruals ought to be offset against materials and supplies. Payments of tax obligations must, of course, be made in cash and not in materials and supplies, and accordingly, any tax accrual funds which may have been invested in materials and supplies would have to be liquidated in anticipation of the tax payment dates. This would seem to mean that for all practical purposes tax accruals are not really available to take care of the materials and supplies requirements of a public utility.

### Commission's Judgment Deserves Respect

In a few other respects, and it was basically by reason of these considerations that the matter was remanded to the Commission, the Court showed a disappointing willingness to accept bare allegations of the intervenors that the Company ought to realize increased income from improved meter maintenance and changes of a limited number of customers from flat rates to metered rates. The Court required the Commission to consider these matters on remand, though they seem too trifling to justify this action.

Furthermore, these would seem to be areas in which the Commission's judgment ought to be respected, without interference by a reviewing court. To the extent that a reviewing court attempts to determine whether a utility ought to realize additional revenues when it changes flat rate customers to meters, or attempts to decide what ought to be the result of a full-scale meter maintenance program, the court would seem to be entering into areas beyond its competence, but where a regulatory body is expert if anyone is. The Court in this instance in its *Alton* decision seems to have disregarded the teaching of the *Knoxville Water Company* case, that Commission orders ought to be regarded as *prima facie* valid when they relate to areas in which the Commission is expert. It should be pointed out, however, that the Court had the good sense not to try to determine what additional revenues might be realized from the change to metering and from improved meter maintenance, but rather remanded the matter to the Commission for the Commission's determination. Nevertheless, the Court seems to have interfered with the Commission's func-

tion by reversing the Commission's order because of these matters and instructing the Commission to consider them once again.

### Fair Value Computations

One relatively important matter of principle decided by the Court goes to the very basis of rate-making. In arriving at its conclusion as to the fair value of the Company's property, the Commission had given relatively less weight to reproduction cost than it gave to original cost; the weighting was approximately 20 per cent for the former and 80 per cent for the latter. Counsel for the Commission thereupon argued to the Supreme Court of Illinois that the Court ought not to be too concerned even if there were mistakes of fact or of judgment in arriving at the conclusions as to what the reproduction cost depreciated of the Company's property might be, since the fair value determination did not depend to any large extent upon reproduction cost. The Commission's counsel argued that the Court therefore need not and ought not to inquire into the propriety of the specific findings that went to make up fair value, but should concentrate only upon the finding as to fair value itself. This view was rejected by the Court in the following language:

" . . . The Commission objects particularly to setting aside its order because of purported errors in computing reproduction value less depreciation when the final fair value determination is not challenged as unreasonable. It argues that if the final determination is reasonable the courts should not inquire into the separate elements of value which are considered in reaching that finding. This position ignores the right of the parties and the public not just to a reasonable determination but rather to a determination which arises from sound and lawful analysis of the problems presented. Without power to review the intermediate steps in the administrative decision-making process, effective judicial review would be extremely difficult if not impossible. Neither the statute nor this court's decisions in the rate regulation field indicate that such a result is intended. This court has not confined its review to the Commission's final order but rather, when called upon to do so and with respect for the Commission's expert judgment, it has reviewed the elements of value considered by the Commission in computing present fair value. (See *Peoples Gas Light & Coke Co.* v *Slattery*, 373, *ILL.* 31, 51-56) . . ."

Of course an argument of the kind which the Commission made in this instance runs the risk of being interpreted as an argument in favor of the doctrine of the *Hope* case (*F.P.C.* v. *Hope Natural Gas Company*, 320 U.S. 591), which is generally interpreted as constituting an approval of the doctrine that Commission rate orders ought not to be upset if the end result can be justified, without regard to what methods may or may not have been used in arriving at the end result.

### Finality of Commission's Order Lacking

The most disappointing aspect of the *Alton Water Company* case is the amount of time that has been and will be consumed before there is any finality in the Water Company's rate situation. Upon the remand, the Commission entered a supplemental order establishing rates somewhat below the rates which it had previously approved and which had been the subject of the appeal. These latter rates are themselves, however, being made the subject of an appeal and hence three and one-half year after the original filing, there is still no finality to the Commission's order. There likewise remains in litigation and unresolved the extent, if any, to which the Company is required to make a refund to its customers on account of the increased rates charged pending appeal to the Supreme Court of Illinois, after the lower reviewing court had found the rates as established by the Commission to be unlawful.

Certain procedural revisions ought to be worked out so that a situation of this kind can not be allowed to develop. The problem is particularly acute in the case of a small utility, such as a water company, which may find some satisfaction in seeing important questions of public utility law resolved in favor of the utility industry, but is not nevertheless in a financial position to withstand long periods of uncertainty before determination of the propriety of its rate increase proposals.

## Sioux City Waterworks Annual Report

The 1960 waterworks report from Sioux City, Iowa, reports 28,645 ft of pipe laid and 17,021 ft abandoned during the year. The installation of two submersible pumps was undertaken for the first time this year. An excessive amount of iron and manganese was also reported over standards set by the US Public Health Dept., with steps being taken to correct the situation. Total consumption for year 1960 was 3,582,113,550 gal for a population of 89,159 or an average of 110.04 gal per person. Storage capacity is 26 million gal and pumping capacity is 24 millon gallons per day, from the 12 wells.

## New Electronic Assembly Plant for Foxboro Co.

A $700,000 assembly plant in East Bridgewater, Mass., was opened June 5 by The Foxboro Company,

Foxboro, Mass., manufacturers of industrial instruments for measurement and control.

The new 40,000 sq ft plant, and a 150 member staff, will allow Foxboro to expand the manufacture and assembly of Electronic Consotrol Instruments which are being specified for process control systems.

Production of all solid-state electronic line has already been transferred to the new plant. The ultimate aim is to expand this facility to handle the increasing demand for electronic instrumentation in all phases of industrial processing.

The new plant, a single level structure of brick and aluminum siding, is located on a 120-acre site and built with future additions in mind. This plant brings the total to six for Foxboro factories.

# A Correction And An Apology

Our editorial entitled "A Lesson and a Moral" (WATER & SEWAGE WORKS, May 1961, page 203) has furnished your editor with a lesson of his own. We have been advised by the discharged consulting engineer of the Jersey City Sewerage Authority that, in his opinion, the alleged deterioriation of the plant was caused primarily by a lack of revenues which in turn resulted in substantially less expenditure than had been recommended by him for the maintenance and operation of the system every year since 1958. The engineer has assured us that the fired employees were competent and capable men, and he has furnished us with a summary of their qualifications and experience which confirms this.

Our editorial was not intended to reflect adversely upon the competency of any specific individual or individuals. Nor did we intend to take sides in a political controversy, which some of the press releases indicate may have been involved in this matter. We were simply calling attention, to problems which can arise in any sewage treatment system, without attempting to analyze the specific causes of the Jersey City episode.

We retract any statement which could have adversely reflected on the competency of the discharged employees or the consultant and apologize for any embarrassment or other difficulties which our editorial may have caused them.

*V. W. Langworthy*

# Water Pollution Control Federation

## *34th Annual Meeting*

HOST ASSOCIATION — CENTRAL STATES
SEWAGE AND INDUSTRIAL WASTES ASSOCIATION

HOTEL SCHROEDER
*Milwaukee, Wisconsin*

AUDITORIUM - ARENA
*October 8-12, 1961*

### TECHNICAL PROGRAM

**SUNDAY, OCTOBER 8**

Exhibits and Early Registration
1-5 PM

**MONDAY, OCTOBER 9**

MORNING

Call to Order
*President* RAY E. LAWRENCE
Invocation
Address of Welcome J. F. FRIEDRICK
The Milwaukee Story RAY D. LEARY

AFTERNOON

Water Pollution Roundup
What We Know About Wastes and Pollution GORDON M. FAIR
What We Need to Know About Wastes and Pollution THOMAS J. POWERS
Getting Answers to Needed Information About Wastes and Pollution S. A. BERKOWITZ

**TUESDAY, OCTOBER 10**

MORNING

CONCURRENT SESSIONS

***A. Large System Design***

Design of Hamilton, Ontario, Sewer System and Sewage Treatment Works D. B. REDFERN
Large Sewer System Design G. A. HORSTKOTTE, JR.
Planning, Development, and Administration of Intercommunity Sewerage and Sewage Treatment Systems in a Metropolitan Complex
Part 1. The Wayne County, Michigan, Situation GEORGE BINGHAM
Part 2. The Oakland County, Michigan, Situation R. J. ALEXANDER

***B. Industrial Wastes Forum***

Surface and Subsurface Disposal of Industrial Wastes
Spray Irrigation as a Means of Industrial Waste Disposal H. G. LULEY
Ridge and Furrow Irrigation for Industrial Waste Disposal F. H. SCHRAUFNAGEL
Disposal of High Organic Content Wastes on Land R. H. SCOTT
Fundamentals of Underground Disposal of Industrial Wastes CHARLES W. QUERIO

NOON

FEDERATION ANNUAL BANQUET
Outstanding Speaker to be Announced

AFTERNOON

INSPECTION TRIP
Wastewater Treatment Plant of the Sewerage Commission of Milwaukee

INDUSTRIAL WASTES SESSION

Preventive Measures Get Results in Solvay's Waste Abatement Program W. L. LEUCHT
P. T. MCNALLY, and IRVING GROSSMAN
Anaerobic Digestion of Textile Desizing Wastes THEODORE JAFFE
The Relationship Between Phenol Concentrations and Medicinal Odors in Water M. KATZ and C. J. BRADAC

**WEDNESDAY, OCTOBER 11**

MORNING

CONCURRENT SESSIONS

***A. Industry Day***

The Cooperative State and Industry Survey of the Columbia River R. O. SYLVESTER
Present Status of Commercial Scale Operation of Stream Reaeration Facilities AVERILL J. WILEY
Waste Abatement Progress in the Pulp and Paper Industry HARRY W. GEHM
A Solution to Industrial Wastes Disposal—Tailor-Made Answers Not a Panacea RICHARD BILLINGS

***B. The Great Lakes Resource***

Physiography of the Lakes NORMAN BILLINGS
Water Uses G. A. ROHLICH
Current and Future Problems and Needs to Be Served ALBERT E. BERRY
Significant Aspects of the Great Lakes-Illinois River Basins Projects H. W. POSTON and WM. Q. KEHR

NOON

INDUSTRY LUNCHEON
Address by John G. Strange, President, The Institute of Paper Chemistry

AFTERNOON

CONCURRENT SESSIONS

***A. Industry Day***

Mead's Experience with Plastic Filter Media at Rome, Georgia VIRGIL A. MINCH
*Discussion* W. H. WEIR
Biological Treatment of Fine Chemical Plant Wastes W. R. HORN
*Discussion* CHARLES S. BROWN
Presenting a Waste Control Program to Management CHARLES L. SERCU

***B. Maintenance Forum***

Problems with Pump Operation and Maintenance R. C. THAYER
Chlorination Operation and Maintenance Problems A. A. THOMAS
Sewer Maintenance at La Crosse, Wisconsin CARL WAHLSTROM

***C. Sludge, Research Needs and Collection***

New Developments in the Zimmermann Process F. L. ZIMMERMANN and NEAL SEEGERT
Water Pollution Control Research: Need for Renewed Effort FRANK A. BUTRICO
Garbage, Detergents, and Sewers FRANCIS R. BOWERMAN

**THURSDAY, OCTOBER 12**

LABORATORY SCIENTISTS' BREAKFAST

Detection and Measurement of Exotic Substances GORDON E. MCCALLUM

MORNING

CONCURRENT SESSIONS

***A. Research Symposium***

Organic Composition of a Domestic Sewage J. HUNTER and H. HEUHELEKIAN
Composition of Volatile Solids Accumulating in an Activated Sludge System DONALD R. WASHINGTON and JAMES M. SYMONS
Arginine, Cystine, and Glycine Utilization by Activated Sludge DALE A. CARLSON and L. B. POLKOWSKI
The Chromatic Assay of Extracellular Products of Algal Metabolism ROBERT C. MERZ, JOHN R. KILMA, and R. G. ZEHNPFENNIG

***B. Operator's Forum***

Short Cuts and Improvements in Laboratory Procedures W. D. HATFIELD
Sludge Drying Lagoons N. S. BUBBIS
Stirring Digesters with Gas HUGH A. SCHREIBER
Mechanical Nozzles for Aeration Tanks CHARLES E. HUGHES

AFTERNOON

CONCURRENT SESSIONS

***A. Research Symposium***

Analysis of the Economics of Sewage Treatment JOHN A. LOGAN, W. D. HATFIELD, GEORGE RUSELL, and WALTER R. LYNN

CONTINUED ON PAGE 94A

# 10 Foot View Of 26,050 Foot Water Line

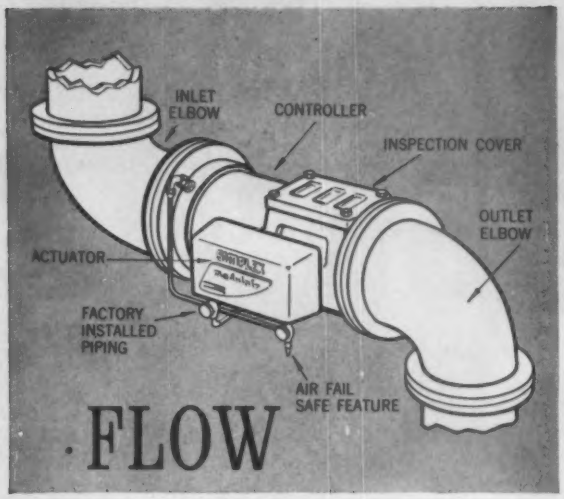
A little bulldozer was used to good advantage on this 48-inch five-mile water supply line in Columbus, Ohio. The first job it did for the Complete General Contracting Company of Columbus was to level the bottom of the trench and prepare a bed for the pipe.

After the crane lowered the pipe, a workman placed blocking in the bell and the little dozer shoved the pipe home as shown in the picture at the top of the page. The line was installed under the direction of Ernest H. Stork, Director, Department of Public Service and Frank Wright, Superintendent, Division of Water, Columbus, Ohio.

On other parts of the job, a backhoe was used to dig the trench, place the pipe and shove the joint home. Burgess & Niple of Columbus were consulting engineers. The pipe was manufactured by Price Brothers Company, Hattiesburg, Mississippi and Dayton, Ohio.

Price Brothers

CONCRETE PRESSURE PIPE




# How to control it economically with this simple, modern "box on a pipe."

This is the Modulair Type "P" rate-of-flow controller, for your filter effluent piping.

You install it almost as easily as a piece of pipe, and its design is so utterly simple that you have almost no maintenance cost.

Note how Modulair "P" flow controller requires very little space in filter effluent line.

In fact, the minute you put this venturi-actuated, fully pneumatic controller to work, you get these new savings:

1. No valve operator
2. No water supply
3. No hydraulic valves
4. No drive gears and linkage
5. No "spaghetti" of complicated piping
6. No pilot valve or valve shaft
7. No leaky packing gland
8. No floor drain
9. Almost no maintenance

You save space, too, because the "P" controller has the shortest laying length of any, in addition to being entirely preassembled, with all working parts enclosed.

Send for our Bulletin 951, for details on space and cost savings of the "P" controller. Compare them with your present method of flow control. No obligation.

**SIMPLEX® VALVE AND METER CO.**
LANCASTER, PENNSYLVANIA
a division of
**PFAUDLER PERMUTIT INC.**


# Meetings

CONTINUED FROM PAGE 20A

Oct. 2-4—Taos, New Mexico. ROCKY MOUNTAIN SECTION A.W.W.A. Secy., H. F. Kepner, 550 Alcott, Denver 4, Colorado.

Oct. 4-6—Roanoke, Virginia (*Hotel Roanoke*) VIRGINIA SECTION A.W.W.A. Secy., Edward H. Ruehl, R. Stuart Royer & Assocs., 15 W. Cary St., Richmond 20.

Oct. 4-6—Jamestown, North Dakota (*Gladstone Hotel*) NORTH DAKOTA SECTION WATER & SEWAGE WORKS CONF. Secy., W. Van Heuvelen, c/o State Dept. of Health, Bismarck, N. Dakota.

Oct. 5-6—Twin Falls, Idaho. INTERMOUNTAIN SECTION A.W.W.A. Secy., M. W. Snell, Supt., Power & Water, Soda Springs, Idaho.

Oct. 8-11—Biloxi, Miss. (*Buena Vista Hotel*) ALA.-MISS. SECTION A.W.W.A. Secy., Ernest Bryan, McWane Cast Iron Pipe Co., Box 2601, Birmingham, Ala.

Oct. 9-12—Milwaukee, Wis. (*Schroeder Hotel*) THIRTY FOURTH ANNUAL MEETING WATER POLLUTION CONTROL FEDERATION. Secy., Ralph E. Fuhrman 4435 Wisconsin Ave., Washington 6, D. C.

Oct. 9-20—Cincinnati, Ohio (*Robert A Taft Sanitary Engineering Center*) Short Course: Basic Radiological Health. Write: Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, or to a PHS Regional Office.

Oct. 15-18—San Antonio, Texas (*Hilton Hotel*) SOUTHWEST SECTION A.W.W.A. Secy., L. A. Jackson, Municipal Water Works, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 16-27—Cincinnati, Ohio (*Robert A. Taft Sanitary Engineering Center*) Short Course: Plankton Identification and Control. Write: Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, or to a PHS Regional Office.

Oct. 17-20—Atlantic City, New Jersey. EASTERN WATER CO. CONFERENCE

Oct. 17-Nov. 9—New Brunswick, N. J. (*Rutgers University*) Short Course: Sewage Disposal and Plant Operation. Contact Dean, College of Engineering, Rutgers, The State University, New Brunswick, N. J.

Oct. 18-20—Cedar Rapids, Iowa (*Roosevelt Hotel*) IOWA SECTION A.W.W.A. Secy., Wilbur E. Bjork, Des Moines Water Works, 1003 Locust St., Des Moines.

Oct. 22-25—Montreal Quebec (*Mount Royal Hotel*) CANADIAN INSTITUTE ON SEWAGE & SANITATION. Secy., Albert E. Berry, 72 Grenville St., Toronto, Ont.

Oct. 23-25—Pittsburgh, Pa. (*Penn-Sheraton Hotel*) INTERNATIONAL WATER CONFERENCE OF THE ENGINEERS SOCIETY OF WESTERN PENNSYLVANIA. Write: Society Office, Penn-Sheraton Hotel, Pittsburgh 30, Pa.

Oct. 23-27—Monticello, Illinois (*Allerton House*) TENTH ANNUAL WATER WORKS MANAGEMENT SHORT COURSE. Sponsored by Illinois and Indiana Sections A.W.W.A. Write: Short Course Supervisor, 116b Illini Hall, Champaign, Ill.

## EDITORIAL—
## A CLEANER TOMORROW

CONTINUED FROM PAGE 317

nite advance, yet the problem continued to grow faster than our means of coping with it. The 1961 legislation establishes a Federal-State-local attack capability that is closer to meeting our urgent need than any we have had before.

The new legislation does five important things:

—It broadens and strengthens the Federal Government's enforcement powers.

—It provides the basis for a greatly stepped-up program of waste-treatment works construction.

—It authorizes increased Federal support of State and interstate pollution control programs.

—It calls for an intensified program of research looking toward more effective methods of pollution control, with special emphasis on regional variations.

—It establishes in law the principle of water quality control as a criterion in planning and building Federal reservoirs.

The most important enforcement provision of the new act extends Federal pollution abatement jurisdiction to all navigable waters, including interstate and coastal waters. The earlier, 1956 law limited Federal jurisdiction to interstate waters where it could be shown that pollution arising from a source in one State was threatening the health and welfare of people in another State. This obviously made the Federal enforcement program dependent on the purely geographical accident of where a pollution source happened to be located.

Under the new law, Federal enforcement action can be initiated at the request of the Governor of the State in which the pollution originates, even though the pollution is confined to that State. Similarly, if Federal Court action against intrastate pollution becomes necessary, this can be initiated with the consent of the Governor. Thus, in a purely intrastate matter, the prerogatives of the State are preserved. At the same time, however, the mechanism is established to bring into play the power of the Federal Government against those responsible for intrastate pollution, if the State desires it. This is a significant step forward.

The new law also broadens the Federal Government's authority in interstate pollution situations. Under the previous law, the Government on its own initiative could call a conference in connection with an interstate pollution problem, but it could initiate Federal Court action only with the consent of the State in which the pollution originated or at the request of a downstream State. Under the new law, court action can be initiated by the Government without such request or consent. Furthermore, the new law gives municipalities a more definite role in the initiation of Federal enforcement action in interstate situations.

The new law provides for very considerable increases in grants to cities for the construction of waste treatment facilities. During the early 1950's, cities spent an average of $220 million per year to build treatment facilities; after the 1956 amendments, which for the first time authorized Federal construction grants, annual expenditures rose to $360 million, all but about one-tenth of which consisted of local funds. But this still has not been enough. To do the job that needs to be done, construction must be increased to a level of $600 million a year for the next ten years.

The new law will help accompish this. Instead of $50 million per year in grants to municipalities, we will be able to provide $80 million in fiscal year 1961-62, $90 million in the following year, and $100 million for the next four years.

We will also be able to increase the size of our grants to cities, from an over-all limit of $250 thousand to $600 thousand. This latter figure is far more realistic, in view of today's costs, and it corrects a weakness in the earlier legislation. A grant of $250,000 can mean much to a small community but it is not very meaningful to a larger one, whose waste-treatment facilities may represent a capital investment of many millions of dollars. Large grants will be a greater incentive to these larger communities.

Another provision of the new law permits several cities to join together to build a joint treatment facility. Each community can then receive an individual grant based on its share of construction costs, up to a limit of $2,400,000 for the total project.

The new law also authorizes an increase in Federal grants to States from $3 to $5 million annually. These grants are to assist State and interstate water pollution control agencies to establish and maintain their water pollution control measures.

The need for research in water pollution abatement has been stated too often to require restatement here. We need to know more about the character of our wastes, how they affect our water, and how we can remove them from the water economically and effectively. Congress has now authorized a greatly increased research program, including establishment of a series of regional laboratories in various parts of the continental United States and Alaska. This regional approach is a wise one; problems of waste disposal and pollution abatement differ greatly from one part of the country to another, and demand different scientific and engineering research.

Finally, the 1961 legislation directs the various agencies of the Federal Government to consider water-quality control as a criterion in planning reservoirs and impoundments. This provision of the law recognizes the engineering principle of "low flow augmentation," under which water is stored during periods of heavy rainfall and then added to the stream during periods of low flow to reduce the levels of water pollution. The law points out, however, that this is to be used as a supplement to other pollution abatement techniques and not as a substitute for them.

Last March, in my testimony before the House Public Works Committee in support of the President's recommendations for this new legislation, I said:

"This is an excellent bill in its emphasis on research, on flexibility, on partnership among the different levels of Government—in fact, in its whole tone of aggressive action against the Nation's No. 1 pollution problem. All these things make it a truly historic piece of legislation."

I am happy to restate this evaluation here. Our country and our people are the gainers, now that a cleaner tomorrow is dawning for America's water.

# Equipment News

CONTINUED FROM PAGE 15A

## Tubing Benders

Six sizes of tubing benders recommended for use with soft or hard copper, aluminum and certain sizes of stainless steel tubing, as well as brass tubing, are announced by this manufacturer.

The six benders (model numbers 293 through 298) will accommodate tubing of 3/16, ¼, 5/16, ⅜, 7/16 and ½ in. O.D. respectively. Forming shoes and rolls for each size are manufactured of high-grade steel to prevent marring and deformation during bending operations.

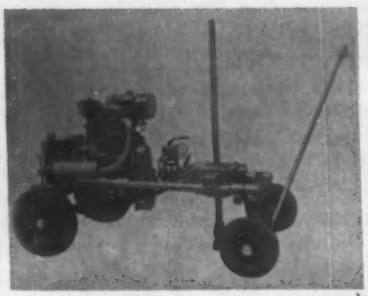
The benders are specially designed for easy application and removal when working with tubing which is already installed or where access is difficult.—The Ridge Tool Co.

**Circle No. 819 on Reader Service Card**

Payne Dean & Company, Clinton, Conn.

**Truck-mounted, hydraulic valve operators provide fast, safe control of 10" to 60" valves**

One Man Control of Speed and Torque on Gate Stem with Indication. Two Safety Control Devices.

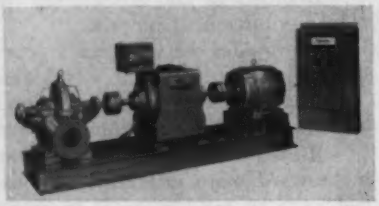


4-Speed Electric Motor Gatenders. For Floor-Stand and Under Floor Operation. 1 to 5 HP 10" To 36" Valves.

Portable Engine Driven Gatenders, For Valves 10" to 36". All Hydraulic Operation. Two Safety Features.

## Pre-determined Pressure System

Hydro-Constant Pressure System, announced by this manufacturer, is a tankless pressure system that maintains a pre-determined pressure, regardless of changes in the system pressure, by varying the pump speed through a fluid drive coupling or other variable speed drive.



A Hydro-Constant system is used in place of a hydro-pneumatic system, finding application in service where a pressure tank has been used, house pump service, water works service, industrial plant service and booster service.—Peerless Pump Div., Food Machinery and Chemical Corp.

**Circle No. 820 on Reader Service Card**

## Ball Valves

A new line of ball valves in combinations of metals, seats and seals to handle practically any fluid, has been announced by this manufacturer.

Featuring adjustable stem seal, a self-adjusting ball which seals with flow in either direction, and stem shoulder to prevent ball from being forced downward, the line includes valves with Navy G bronze or semi-steel cast bodies; or brass, steel and 303 or 316 stainless steel bar stock bodies. Valve sizes range from ¼ to 2½ in. for pressures up to 400 pounds water-oil-gas, and temperatures to 450° F.—Homestead Valve Mfg. Co.

**Circle No. 821 on Reader Service Card**

## Swimming Pool Water Disinfection

A new product, highly effective in the chemical treatment of swimming pool water has been announced by this manufacturer.

Identified under the trade name of HIO-DINE, the material is based on the element Iodine and primarily releases Hypoiodous acid (HIO) which does not evaporate under the influence of the sun and is highly antimicrobial. HIO does not combine with ammonia to form ioda-

mins, it does not irritate the eyes, delicate mucous membranes or skin. In addition, it has no bleaching effect on hair, fabrics or plastics. It has no disagreeable odor or taste, does not stain or form scales. It does not change the pH of the water and is not affected by water hardness.—Voldale, Inc.

**Circle No. 822 on Reader Service Card**

## Fire Hydrant

A new fire hydrant, Model H100, featuring bronze-to-bronze seat ring threads, permanent lubrication, and a unique design seat removal wrench, has been added to the well-known line of A. P. Smith products.

The Model H100 hydrant conforms to current AWWA specifications and is produced with 4½ in. and 5¼" internal valve openings for working pressures up to 150 lbs. When equipped with a high pressure pilot valve, the hydrant is suitable for working pressures up to 200 lbs.

In addition to the Model H100 hydrant, this manufacturer produces high pressure, warm climate, and flush hydrants along with valves and inserting and tapping equipment.—The A. P. Smith Mfg. Co.

**Circle No. 823 on Reader Service Card**

## Pipeline Ditcher

Designed for extra-heavy-duty digging, this manufacturer's Model 318 Pipeliner offers many advantages.

Equipped with a torque converter it also features hydraulic wheel hoist and conveyor drive as standard equipment. Main transmission has two separate output shafts to furnish power independently for both traction and excavator drive. Antifriction bearings in all main power trains reduce wear and power loss. Maximum cutting depth: 7 ft; widths of cut: 30 in. to 44 in. in 2 in. units.—Gar Wood Industries, Inc.

**Circle No. 824 on Reader Service Card**

SINGLE PASSAGE IMPELLERS
WITH MULTI-BLADE BALANCE

AURORA® MONO-VANE NON-CLOG PUMPS

BENEFIT FROM THE SPECIAL ADVANTAGES OF SINGLE PASSAGE IMPELLERS. WITHOUT THE USUAL VIBRATION.

The Mono-Vane patented design provides a natural rotational and mechanical balance. *There is no need for separate counterbalance* . . . and the Mono-Vane can be trimmed to suit various head and capacity requirements, retaining balance through the entire curve from shut-off to wide-open.

The Mono-Vane impeller is especially effective for long, stringy materials . . . and it is up to *20 times more non-clog* than the conventional 2-blade impeller. Maximum economy of investment and operation is assured . . . the Mono-Vane operates effectively for a given head and given solids size at ½ the capacity and *½ the horsepower.*

Ask today for Free Bulletin 1218

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# New Literature

AVAILABLE FREE

## New Cast Chain Bulletin

12-page Bulletin, No. 6163P, presents the complete story of the design and manufacture of Rex Cast Chains. The bulletin illustrates how research, design engineering, modern manufacturing methods and quality control procedures combined produce the most dependable, cost-reducing cast chain possible. Actual lab, shop and application photos present a new insight into the built-in qualities of all Rex Cast Chain lines.—Chain Belt Co.

Circle No. 825 on Reader Service Card

## Pumping Equipment

12-page condensed application guide catalog covers the complete range of pumping equipment offered by this manufacturer.

The line of pumps includes a type, size and capacity to meet practically every requirement—sizes to 152 in., capacities to 800,000 gpm, heads to 3000 psi, for many kinds of clear liquids and those containing solids in suspension.

To aid in selection, the Guide includes a chart which gives the basic data on the following types of pumps: End Suction, Split Case, Non-Clog, Biltogether, Peripheral, Turbine, Propeller, Sump, Coolant, Fire and Rotary.—Fairbanks, Morse & Co.

Circle No. 826 on Reader Service Card

## Tapping Manual

12-page manual recently issued by this manufacturer describes the step-by-step procedure for tapping prestressed concrete steel cylinder pipe under pressure.

The handy booklet discusses the basic construction of the pipe, and describes how small and large taps can be made quickly and safely with ordinary tapping tools and with no interruption in service.—Price Brothers Co.

Circle No. 827 on Reader Service Card

## Aeration Equipment

Bulletin No. 7316, a four-page brochure, illustrates and describes this manufacturer's D-O Aerator.

This is a high capacity, motor driven mixing unit designed to increase both the effectiveness and the rate of oxygen absorption over presently employed methods. It can be adapted to a variety of tank sizes and is readily incorporated into existing tanks.

The bulletin discusses the primary requirements of all activated sludge aeration equipment, the design features of this unit, and the advantages that it offers. Illustrative drawings show typical installations in both round and rectangular tanks.—Dorr-Oliver Inc.

Circle No. 828 on Reader Service Card

## Improved Meter for Use With Parshall Flumes

Bulletin No. 1200-A, a 12-page brochure, illustrates and describes this manufacturer's New Type "ML" Meter introducing a new concept in measuring of flow through Parshall flumes.

The bulletin discusses the operation, design features, advantages and

ACCURATE GRAPHIC AND VISUAL REGISTRATION
of liquid flow with
STEVENS
RECORDER TYPE B-FT

Recording, indicating and totalizing meter for measuring sewage or other flows over Parshall flumes and weirs. This instrument has interchangeable flow cams and flow conversion gears... an important factor to consider for sewage treatment plants in rapidly growing communities. With a simple change of cams and gears the Type B-FT Recorder can operate with a different size flume or accommodate a greater range of flow than that for which it was originally purchased. The change does not require factory service. Similarly, change from weekly to daily time scale, or vice versa, is accomplished by merely repositioning one gear — no new parts to buy.

This recorder can be direct float operated or remotely controlled and is available for wall or switchboard mounting, or with cabinet for mounting out of doors directly over the float well. Request BULLETIN 25 for complete details.

STEVENS HYDROGRAPHIC DATA BOOK
Invaluable for your reference file. Contains technical data on recorder installations, plus a wealth of hydraulic and conversion tables. $1 copy. (No COD's)

LEUPOLD & STEVENS INSTRUMENTS, INC.
4445 N. E. GLISAN STREET • PORTLAND 13, OREGON
Specialists in hydrologic instruments for over half a century.

installation of the new meter, designed specifically to simplify and improve metering devices of the water float operated type.—Penn Instruments Div., Burgess-Manning Co.

Circle No. 829 on Reader Service Card

## Flotation Separators for Waste Water Treatment

8-page Technical Bulletin PS-3 illustrates and describes this manufacturer's flotation separators for waste water treatment.

The flotation process is highly efficient on wastes with accompanying fractions such as emulsified oils and suspended materials of specific gravities approaching that of the liquid phase. These materials may neither float nor sink in gravity separation basins. They may also be flocculent in nature or of too small a size for economic screening or filtration. In these cases effective separation can be obtained by proper flotation methods. Bulletin discusses design features, operating principles and applications.—Pacific Industrial Engineering, Inc.

Circle No. 830 on Reader Service Card

## Eccentric Valve

Bulletin 110, an eight-page brochure, illustrates and describes this manufacturer's line of eccentric valves.

The bulletin lists features of the valve as well as materials, pressure ratings, dimensions, and accessories, and outlines the broad areas where the valves are extensively used in the Pulp and Paper Industry, Sewage and Water Treatment Plants, Air Conditioning Installations, Chemical Processing Industries, and many other fields.—DeZurik Corp.

Circle No. 831 on Reader Service Card

## Instruments and Controls

Bulletin G14-1, a four-page brochure, describes and illustrates the complete line of Instruments and Controls available from this manufacturer.

The bulletin includes fluid meters for recording, indicating and integrating; transmitters and recorders for pressure and draft; level transmitters; and temperature instruments. —Bailey Meter Co.

Circle No. 832 on Reader Service Card

## Literature on Tube Fittings

The Lenz Company has recently published a compact, informative, reference circular of applications, and other data dealing with their exclusive, patented "O-Ring Seal with Separate Split-Ring Grip" Tube Fittings.

The many unique features and advantages of the fittings, instruction for their use are covered in detail with drawings of their assembly and application.

Several solutions to difficult installation problems are shown and described with detailed drawings.—The Lenz Company.

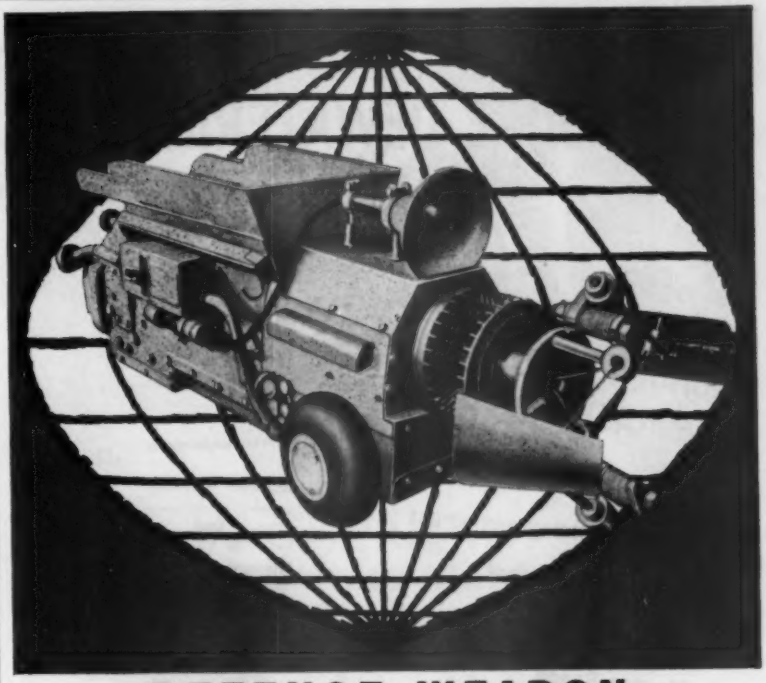
Circle No. 833 on Reader Service Card

## Iron and Manganese Removal

8-page brochure illustrates and describes the use of Carox® Potassium Permanganate for taste and odor control in water treatment, as well as for iron and manganese removal.

This chemical works quickly and efficiently, via both oxidation and ad-

CONTINUED ON PAGE 88A



DEFENSE WEAPON
against the population explosion

CEMENT LINING BY CENTRILINE

More people coming, and that means a booming demand for water. Mains must carry new loads. The Centriline process helps assure full carrying capacity at all times.

Centriline crews, working on pipes in place, clean then line them with a smooth coat of cement mortar. The machine shown above sprays and trowels the new lining, in specified thicknesses up to 3/8", for mains as large as 24". Other Centriline machines can revive old pipe up to twelve feet in diameter.

Centrilining means no more tuberculation or corrosion, and a carrying capacity often greater than when the pipes were new. Of course, Centrilining can be accomplished at a small fraction of the cost of laying new pipe.

Send now for our illustrated brochure which explains the process and shows how Centrilining can help save lines that might otherwise have to be replaced.

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A Subsidiary of Raymond International Inc.
Branch Offices in Principal Cities of the United States, Canada and Latin America

# New Literature

CONTINUED FROM PAGE 87A

sorption, to help provide safe, pure, palatable water. It will solve the problems caused by hydrogen sulfide, industrial wastes, decayed vegetation, algae, and actinomyces. Bulletin explains how to use this chemical in a large rapid sand filtration system and in a small manganese zeolite pressure filtration system. It also includes evaluation procedures for Potassium Permanganate in water treatment.—Carus Chemical Co.

Circle No. 834 on Reader Service Card

## Converting Organic Waste Into Useful Fertilizer

Bulletin No. 158, a four-page brochure, illustrates and describes this manufacturer's Bacti-Cycle Digesters which provide a practical and profitable means of converting municipal garbage and all manner of organic waste into an odorless, friable and stable compost fertilizer. Since the material from input is totally enclosed throughout the process, there is no fly infestation nor objectionable odors; the finished product emerges in 24 hours.

The bulletin describes the process and answers some of the questions on costs, profits, etc., most frequently asked about Bacti-Cycle Waste Digesters.—Earp Laboratories, Inc.

Circle No. 835 on Reader Service Card

CUT
SLUDGE DEWATERING
COSTS 38%
NICHOLS "ROTO-PLUG"*
ELIMINATES NEED FOR:
• Chemicals
• Chemical Mixing equipment
• Metering equipment
• Conditioning equipment
• Storage Space
• High Filter Media Maintenance
The Nichols "Roto-Plug" Sludge Concentrator with its low initial installation cost—plus its inherent efficient and economical operation—places mechanical sludge dewatering within the reach of the smallest community.
It eliminates expensive vacuum and filtrate equipment, chemical mixing and feeding equipment, conditioning equipment, chemicals, and high filter-media maintenance. Savings of 38%, compared with other methods of sludge dewatering, are typical.
Get all the facts. Write today for four-page technical bulletin RP-100.
*Equipment Development Co., Inc.
NICHOLS
Engineering & Research Corp.
60 Pine Street, New York 5, New York

## Engineering Brochure on Advantages of Prefabricated Asphalt Linings

A 14-page illustrated brochure published by this manufacturer presents an informative picture story of the increasing use of Gulf-Seal Prefabricated Asphalt Linings in the rehabilitation of cracked, seeping monolithic reservoirs, the construction of new drinking water reservoirs and the lining of large and small irrigation canals.

These linings have also earned the approval of oil company engineers who have used them in gigantic salt water reservoirs required in LPG underground storage, as well as in waterflooding operations and evaporation pits.

Chemical processing companies use them in eliminating seepage, pollution and erosion arising out of their operations. Farmers and stockmen have controlled seepage and erosion and diverted otherwise wasted water into use for crops and stock, by using these linings.

The information given in the brochure includes installation details, cost data and specifications.—Gulf-Seal Corp., Div., of Bramble Industries.

Circle No. 836 on Reader Service Card

## General Purpose Recorder

Bulletin 24, 11th Edition describes the recently re-designed Type F Stevens Recorder, a general purpose instrument for recording fluctuations of any liquid surface, such as, ground water levels in deep wells, for stream gaging, irrigation, water supply sewage and oil production.

This new recorder design allows the use of either the standard spring driven clock, battery driven solenoid clock or synchronous motor clock, all of which are interchangeable in the field without the use of special tools. The 8-day spring driven clock movement is of a new style wherein the spring, gear train and stain-

less steel escapement are sealed against moisture and dust in corrosion resistant stainless steel and aluminum enclosures. Applications data and instrument specifications are contained in this Bulletin.—Leupold and Stevens Instruments, Inc.

Circle No. 837 on Reader Service Card

## Packaged Water Treatment System

Bulletin CWP-100, an 8-page brochure, illustrates and describes this manufacturer's Helifloc Packaged Water Treatment System, a completely self-contained water purification plant providing disinfection, clarification and filtration. Each system is factory assembled and tested as an integral unit.

The bulletin describes the unique operating principles embodied in the Helifloc design, combining chemical treatment and micro-filtration, which permit broad application of the equipment for both domestic water consumption and industrial usage. Its small size, large capacity and low cost, make it especially suited for residential subdivisions, trailer courts, resorts, industrial plants, etc.—Met-Pro Incorporated.

Circle No. 838 on Reader Service Card

## Compensating Level Recorder or Indicator

Two-page Bulletin M31-2 describing a Bailey instrument for recording or indicating true level, compensated for changes in specific weight, is now available.

The specification sheet describes how the instrument is applied to measure and/or control boiler drum water level, or liquid level in similar closed vessels.

Illustrations and diagrams are used to describe features, installation requirements, characteristics and accessories.—Bailey Meter Co.

Circle No. 839 on Reader Service Card

## Extreme Accuracy Over Wide Range in Pneumatic Transmission

Pneumatic transmission of flow, normally used in conjunction with such differential producers as Venturi Tubes, Dall Flow Tubes, Venturi Nozzles or Orifice Plates is described in a new Specification Data Sheet, featuring the Model 281-01 Transmitter, released by this manufacturer.

The simple functional design of the Model 281-01 Transmitter receives differential pressures on surfaces of mercury in two wells. A cam and pneumatic transmitter mechanism transform these pressures to an output pressure proportional to the main line flow. The Model 281-01 claims an accurate flow range of 8:1 (12-½ - 100% chart/scale) with a tolerance of ±1% over the entire range. The pneumatic output pressure may be used to operate a receiver (any combination of Indicator, Recorder or Totalizer) or pace a dry or liquid feeder.—B-I-F Industries.

Circle No. 840 on Reader Service Card

## Flexible Flanged Coupling Folder

"Flexible Flanged Coupling Adapters" is the subject of a new 12-page brochure (No. 1255) just issued by this manufacturer. It gives detailed information on how these fittings can be incorporated into the design of water, sewage, or gas systems or used for "cutting-in" flanged fitting installations in existing pipelines.

Design drawings show how these products enable flanged meters, valves, regulators, etc. to be quickly

CONTINUED ON PAGE 92A


M&H

Roll-call for water

Indians Say: "Ugh! Too Many White Man!"

In 1814, when Jackson defeated the Creek warriors at Horseshoe Bend, Ala., it probably never had occurred to anyone that someday there would be so many people in the east-south-central States that there could be a shortage of water!

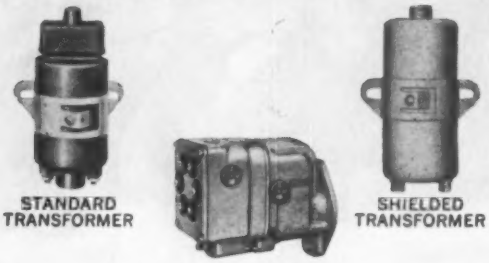
But that Indian defeat was the beginning of a new era. It set the stage for settlement of the Deep South by white people. Immigrants poured into the section, started growing cotton, then corn, then livestock. Later they discovered coal, iron ore and other minerals until sections of this country today support a great industrial economy.

It would have been hard for Andrew Jackson to believe that there ever would be 29 public water systems in this Deep South country, each supplying 25,000 or more population; but that 5 (16%) of the 29 water systems would be of doubtful efficiency and 4 (13.7%) of them would be definitely deficient. Yet, this section of the U.S. is in better shape than the country as a whole where the definite water system deficiency runs 26.6% and the doubtful efficiency totals 23.2%.

Kentucky
Tennessee
Alabama
Mississippi

M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA

IMPROVE ENGINE DEPENDABILITY!
CUT MAINTENANCE COSTS!
NEW FAIRBANKS-MORSE
LOW TENSION IGNITION
...FOR GAS OR GASOLINE ENGINES



STANDARD TRANSFORMER
SHIELDED TRANSFORMER
TYPE FM-LTR LOW TENSION MAGNETO

Best on the market because

- Increases engine life!
- Cuts maintenance and operating costs
- Simplified construction
- Standard flange or base mounting
- Offered in standard and heavy duty models
- Offered with semi-low tension adaptation

This new F-M development gives a positive intense spark. Ozone and high corona discharge do not occur . . . eliminating "green corrosion"; promotes more complete combustion . . . requires far less engine maintenance, fewer spares.

For further details, write: R. D. Hisey; Magneto and Engine Accessories Division; Fairbanks, Morse & Co.; Beloit, Wisconsin.

FAIRBANKS MORSE
A MAJOR INDUSTRIAL COMPONENT OF
FAIRBANKS WHITNEY

# News of Suppliers

## Nichols Engineering & Research Corp. Consolidates Divisions Serving Sanitary Field

Nichols Engineering & Research Corp., New York, announces a major step in its program to increase sales services and provide for planned expansion in the near future.

The Nichols Filtration, Refuse Incinerator and Sewage Sludge Divisions have been consolidated into a Public Works Equipment Division under the leadership of Mark B. Owen, a vice president of the company.

Mr. Owen is a past president of the American Public Works Association and is widely known in the field served by this new division. He is the author of many technical papers and has played an important part in the application of Nichols Herreshoff furnaces to sludge disposal for more than 25 years, beginning with the first installation at Dearborn, Michigan, in 1934.

## Flow Meter Engineering Handbook Available

The third edition of *Flow Meter Engineering Handbook*, compiled and edited by C. E. Cusick, has recently been released. Published by the Brown Instruments Division of Minneapolis-Honeywell Regulator Company, the book discusses primary metering element selection and application. Data are provided about open-channel flow, and equations and formulae for fluid measurement are derived. This reference text is available from the Brown Instruments Division, Wayne and Windrim Avenues, Philadelphia 44, Pa. ($7.50).

## Johns-Manville Corp. Starts Expansion Program

An expansion program to keep ahead of pipe needs being generated by growth of the national economy and to meet the growing United States markets for pipe has been disclosed by Johns-Manville Corporation.

According to R. F. Orth, Senior Operating Vice President, the new Johns-Manville program involves establishment of new business offices in each of 12 key areas throughout the nation, introduction of new pipe products and organization of more technical services for pipe users. Plant capacity is available at seven scattered locations in the United States to absorb immediate increased production requirements, he said, and the company is prepared to build new plants as additional pipe manufacturing facilities are required.

## Speedline Fittings Honored by Dept. of Commerce for New Manufacturing Method

A new method for cold-forming pipe fittings was recently patented by the Speedline Corrosion Resistant Fittings Division of the Horace T. Potts Company, Philadelphia, Pennsylvania.

Pipe fittings can now be simultaneously cold-formed

and sized from any pipe or tubing of standard manufacture. The new method permits rapid production of corrosion resistant pipe fittings in a wide variety of hard-to-work metals and in a full range of wall thicknesses.

The Speedline forming process has been selected by the U. S. Patent Office for showing in their month long 1961 Mechanical Exhibit in the Department of Commerce Building at Washington, D.C. The Speedline Division of the Horace T. Potts Company is one of 16 U. S. firms singled out for having made a significant contribution to the American economy.

Shown above left to right are: Hon. David L. Ladd, U. S. Commissioner of Patents, John W. Reckard, Vice President Horace T. Potts Company. Hon. Edward Gudeman, Under Secretary of Commerce, and Horace T. Potts, II, President of the Potts Company.

## Fred W. Beitner New V. P. of Trent Tube Co.

Mr. Fred W. Beitner has been appointed Vice President, Sales, of the Trent Tube Company, a wholly-owned subsidiary of Crucible Steel Company of America. This announcement was made today by Mr. F. E. Wenzel, President of Trent.

Mr. Beitner joined the Sales Department of Trent in 1946 and during the past 15 years has been a sales engineer, District Sales Manager in New York City and General Sales Manager of the Company.

Mr. Beitner holds a degree in Metallurgical Engineering; he is a member of the National Association of Corrosion Engineers; the Welded Steel Tube Institute and the Engineers Club of America.

## Nuclear Corporation Announces Three Instrumentation Contracts

John S. Rydz, executive vice president of the Nuclear Corporation of America, has announced that the company's newly-reorganized Instrument and Control Division has negotiated three significant contracts.

The first of these supplies The Komline Sanderson Engineering Company of Peapack, New Jersey, with density controls which measure the percentage of solids in sludge by means of nuclear radiation. Komline-Sanderson will have exclusive sales and distribution rights within the sewage industry, and will incorporate the Nucor device as part of its standard waste disposal system.

The second contract was awarded Nuclear Corporation by the Navy to manufacture an undisclosed number of instruments for the detection and measurement of fast neutrons. The third contract, also from the Navy, is for research and development.

Nuclear Corporation of America, headquartered at Denville, New Jersey, is at present composed of three divisions whose products are, respectively, nuclear detection and control instruments, specialized highpower tubes, and rare earth materials research.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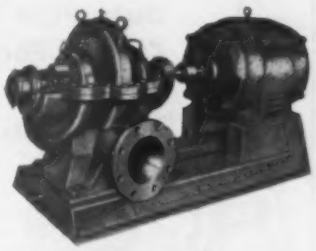
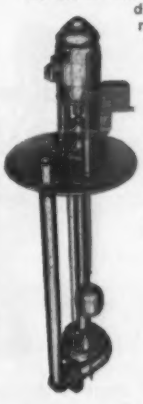
**PUT WEINMAN ON THE PAYROLL**

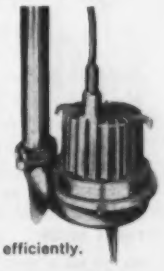
More and more, city engineers recognize the real economy of dependable Weinman Pumps for low-cost, trouble-free handling of drainage, water and sewage. With Weinman, revenue goes further towards meeting the ever-increasing demands on municipal water and sewage facilities. And, rugged Weinman Pumps deliver 'round-the-clock service year after year with only routine maintenance.

For instance, city officials rely on Weinman Type L, Single Stage, Double Suction, Split Case Pumps to move water in volume; for high, medium, and low head pumping to 4000 GPM; for 24-hour-a-day service with no down time. Split case design makes routine maintenance fast and easy.





. . . and, to handle drainage pumping from low to higher level, they look to Weinman's line of Vertical, Submerged, Non-clog Sewage Ejectors. These proven municipal workhorses pump raw sewage and other waste materials without clogging.



. . . or, for permanent or portable sump installations, the Weinman Type M Non-clog, Immersible Pump handles sewage, industrial wastes and drainage water swiftly and efficiently.

So, for a ready solution to growing water problems, consult your Weinman Specialist. He's listed in the Yellow Pages. Or, write direct for descriptive literature.

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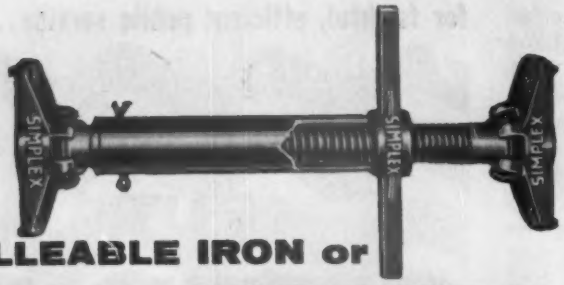


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Ball and socket joints at each end for tight grip at any angle. Blunt lever nuts or 3-way nuts — nail holes in both screw and butt ends. Furnished with or without pipe.

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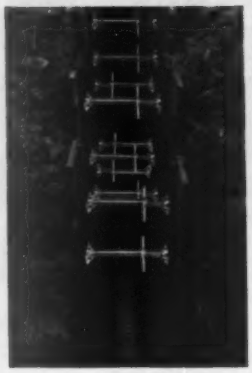

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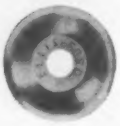

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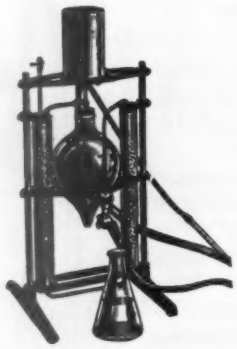

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P. O. Box 2V Richmond 5, Va.


# New Literature

CONTINUED FROM PAGE 89A

and easily installed or removed, have flexibility, and occupy smaller space. —Smith-Blair, Inc.

**Circle No. 841 on Reader Service Card**

## A Better Way to Slake Lime

This manufacturer has just issued "It's A Fact" data on the problem of slaking lime, to obtain homogeneous mixtures, to eliminate grit and clinkers and control hot, dust-laden vapors. This new data, accompanied by pertinent bulletins, describes the accurate and economical solution, featuring the manufacturer's Model 42-01 Lime Slaker.

The two-page data sheet and accompanying bulletins contain illustrations, dimensions and a thorough description of the operation, uses and advantages of B-I-F equipment for slaking lime.—B-I-F Industries.

**Circle No. 842 on Reader Service Card**

## Revised Controlled Speeds Bulletin

An up-to-the-minute brochure on "Controlled Speed System", representing a revision of its previously issued booklet under the same title, has been released by this manufacturer.

The brochure incorporates the advances made in central control instrumentation and panel design, and in signal transmission methods within process-controlled automatic systems. A number of these systems have been revised to utilize the electric U. S. Varitrol motor speed control in applications where pneumatic air pressures may not be available or may not be desirable.—U. S. Electrical Motors Inc.

**Circle No. 843 on Reader Service Card**

## Prestressed Concrete Tanks

New 16-page brochure on circular prestressed concrete tanks is now available from this manufacturer. The brochure contains engineering and construction data on the basic tank elements such as the floor, base, walls and the dome or roof. The use of these tanks for water, petroleum products, chemical and liquid gas storage

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is discussed. There is a section on the economic advantage of prestressed concrete tanks and a new tank capacity chart.—The Preload Co., Inc.

Circle No. 844 on Reader Service Card

## Relief—Unloading Valve

New 4-page Bulletin S-5 describes this manufacturer's Cushioned Automatic Relief-Unloading Valve for steam, air, gas, and fluid control service. These valves are regularly furnished in sizes 2-½ to 24 in. with flanged ends for service to 900 psi. Complete selection data and engineering specifications are included.—Golden-Anderson Valve Specialty Co.

Circle No. 845 on Reader Service Card

## Buyer's Guide Available

A new 1962 Buyer's Guide, of interest to all industries which handle or process liquids or gases, is now available from Pfaudler Permutit Inc.

The 16 page buyer's guide is divided into two primary sections, one dealing with Pfaudler products, the other with Permutit products. Among the former are items of process equipment fabricated from Glasteel, Nucerite, stainless steel, titanium, zirconium, tantalum and other materials for corrosion resistant services. Permutit offerings described include equipment for water treatment, ion exchange, gas analysis, aeration, flow rate metering and control, diminerialization and waste treatment. Each section contains concise engineering data in chart or tabular form.—Pfaudler Permutit Inc.

Circle No. 846 on Reader Service Card


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Six years later the substitute pipeline had to be dug up, at tremendous expense to the taxpayer. Everybody forgot by that time that the framed engineer had screamed for the right pipe in the first place.

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*Name of Air Force base on request.*

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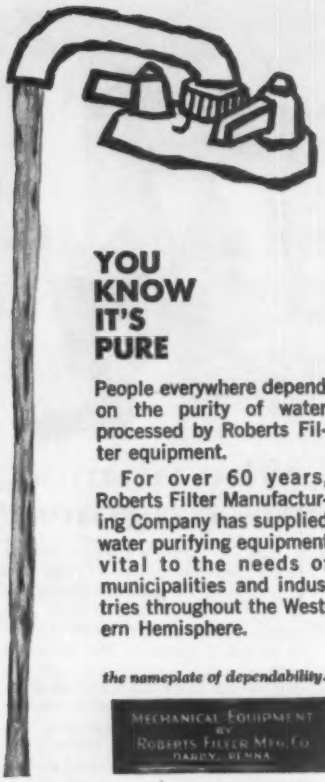

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## WATER POLLUTION CONTROL FEDERATION

CONTINUED FROM PAGE 328

Enterovirus Distribution in Sewage During 1959 Des Moines Poliomyelitis Epidemic JOHN S. WILEY, TOM D. Y. CHIN, CLIFTON R. GRAVELLE, and SHERRY ROBINSON

Ion-Exchange for High-Order Decontamination of Radioactive Wastes A. D. RAY and W. J. KAUFMAN

Controlling Operation to Minimize Activated Sludge Effluent Nitrogen F. J. LUDZAK and M. B. ETTINGER

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Advancement Program of American Water Works Association ERIC F. JOHNSON

Public Relations Program of the Water Pollution Control Federation PHILIP A. RIDGELY

## AWWA DETROIT

CONTINUED FOR PAGE 9A

clean, palatable water entering the distribution system should be just as good at the other end of the line. It is, of course, not so and more attention must be paid to the stabilization of water by chemical treatment to reduce "in the line" problems. Also the quality control organization must be dominated by scientific and technologically competent personnel.

Peak demands are also under scrutiny, both at Johns Hopkins University and in Seattle. During 1959-60, recording meters were studied in residential areas in Towson, Md. and results have not yet been compiled by Johns Hopkins but in Seattle, methods of analysis such as analog and digital computers are being employed for peak demand. The use of network analysis to assist in the operation of a system and in solution of particularly vexing operating problems was discussed.

Finally, it was decided that properly designed demand rates can provide a far more equitable means of assessing charges to individual customers than block-type rates. These are particularly applicable to suburban water systems and wholesale customers. A demand rate also offers the large industrial and commercial customers the opportunities and incentive to reduce total water costs by improving load factors through planned water use.

The entire conference was termed a great success by most attendants.


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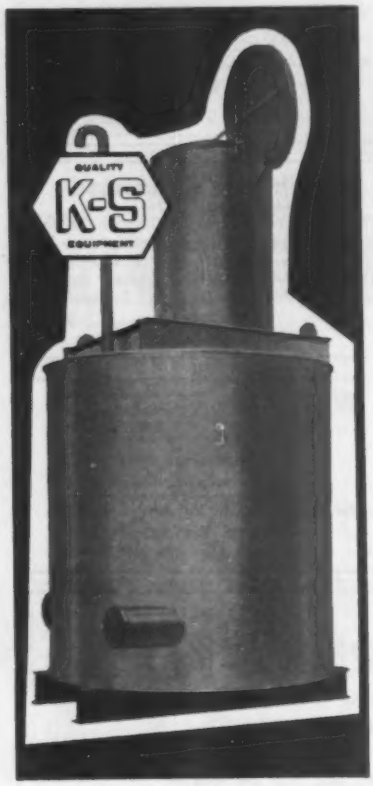


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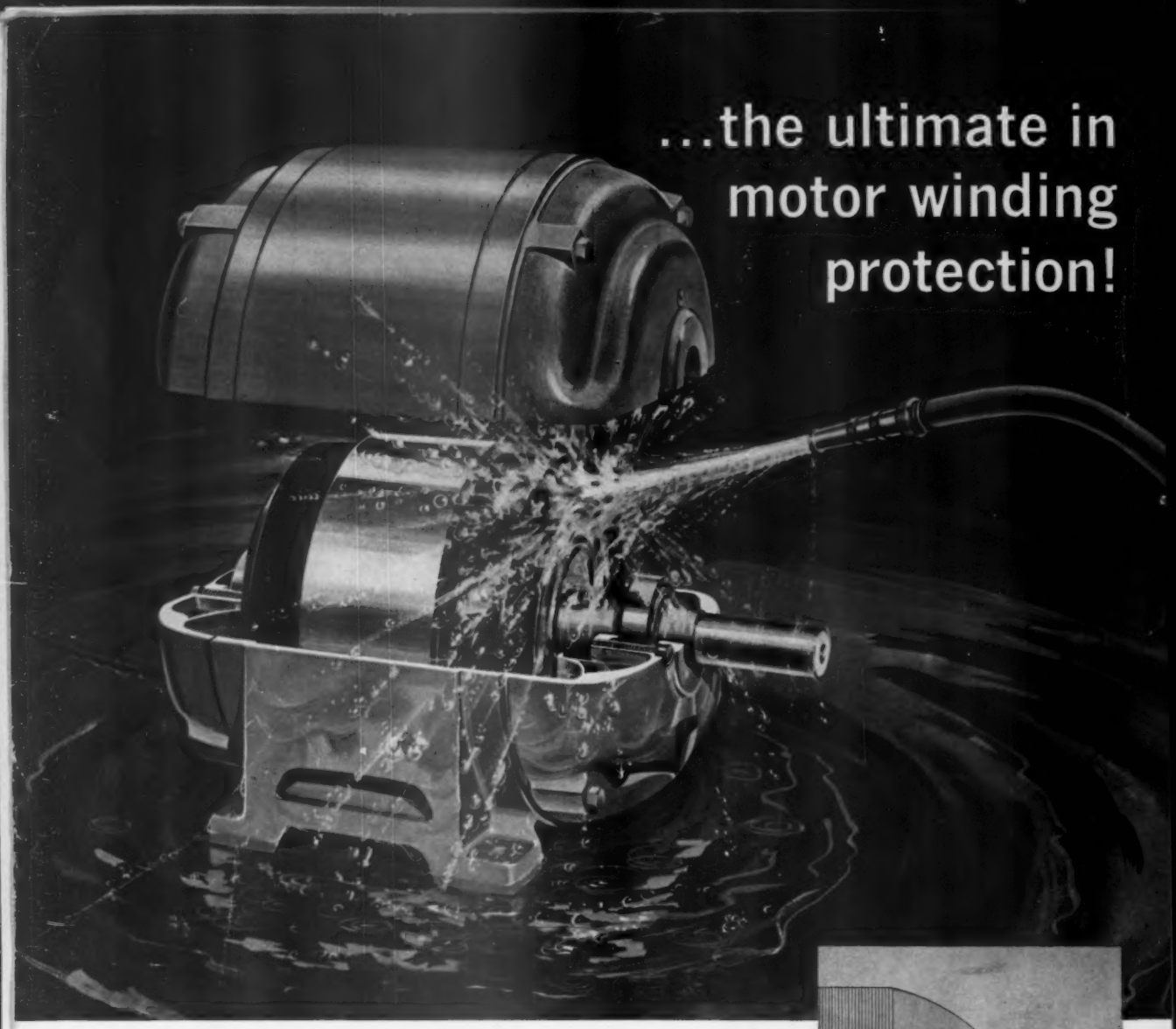

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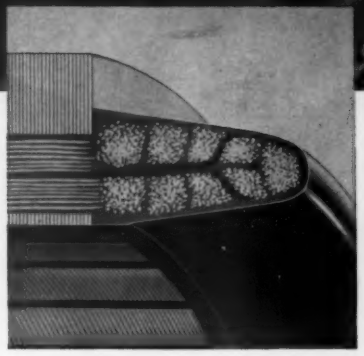

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